University of Alberta

Knowledge Acquisition, Knowledge Retention and Job Satisfaction Among Registered Nurses Following a Critical Care Education Program

by

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Dedication

To my Mother, Evelyn, and in memory of my Father, Emil Mondor … who taught me the importance of education

and

To my Family, Elaine and Michael, Scott, Matthew, Lauren, and Barkley, for their unconditional support and encouragement

Preface

The Pursuit of Knowledge

Ardent desire for knowledge, in fact, is the one motive attracting and supporting investigators in their efforts;

And just this knowledge, really grasped and yet always flying before them, becomes at once their sole torment and sole happiness.

Those who do not know the torment of the unknown cannot have the joy of discovery, which is certainly the liveliest that any man can feel.

Claude Bernard
(1813-1878)

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CHAPTER ONE

Introduction

During the past thirty years, the creation and development of critical care units has created a demand for health care professionals who possess a unique body of critical care knowledge (Chaboyer, Theobald, Pocock, & Friel, 1997; Kennerly, 1990; Roberts, Alspach, Christoph, Kuhn, & Weincek, 1986). The increasing complexity of patient care requirements within critical care units has created both the expectation of and made necessary entry-level competence by all health care staff, including Registered Nurses (Caine, 1990; Johantgen, 2001).

Societal fads and health care trends embody the potential not only to shape nursing practice, but also to influence nursing education (Oermann, 1991; Oermann, Dunn, Munro, & Monohan, 1992). Since the appearance of critical care units in the 1960's, critical care nursing has evolved into one of the fastest growing nursing specialties (Hartshorn, 1992; Oermann, 1991; Sakallaris, 1991). In the province of Alberta, 1923 Registered Nurses currently practice in critical care (Alberta Association of Registered Nurses, personal communication, April 27, 2004).

Within the profession of nursing, critical care nursing exists as a unique specialty whose primary purpose is to care for patients with multiple, complex, and often life-threatening health care problems (Canadian Association of Critical Care Nurses, 1997). Critical care nursing combines an understanding of complex theoretical knowledge with a proficiency in technical skills. Adaptability, innovation, and decision-making are the key components of effective critical care nursing (Kennerly, 1990), and the application of such knowledge and skill is the hallmark of effective

and influential critical care nursing practice (Ferrer Duller, 1995).

Critical care units are frequently characterized by inadequate staffing levels, large staff turnover, illness and absenteeism (Evers, Odom, Latulip-Gardner, & Paul, 1994). As the demand for experienced critical care nurses has often continued to exceed supply, coupled with the shortage of Registered Nurses that has been predicted to continue for at least the next 10 years (Canadian Nurses Association, 1997), the recruitment of both newly graduated and experienced Registered Nurses into these rapidly changing and highly unpredictable nursing environments, despite one's educational preparation or nursing background, has been strongly encouraged and actively pursued (Boyle, Popkess-Vawter, & Taunton, 1996; Hartshorn, 1992; Oermann et al., 1992).

Critical care nursing education programs exist to facilitate not only the recruitment and retention of qualified nursing staff (Lewis, Teinert, Fadol, Seidel, Quint, Zimmerman, & Hamilton, 1992; Sakallaris, 1991), but also for the purpose of facilitating acquisition and retention of both "basic" and advanced critical care nursing knowledge (McKane & Schumacher, 1997; Oermann, 1991; Rottet & Cervero, 1986). The rapidity of change within critical care, in terms of advances in technology, treatments, and procedures, has made the actual forecast of needed knowledge difficult to predict (Roberts et al., 1986). However, basic critical care nursing knowledge, information that provides Registered Nurses with a foundation for critical care nursing practice (Toth, 1984), is both required and necessary. Basic critical care nursing knowledge assists nurses in interpreting findings from clinical assessments, formulating plans of care, conveying pertinent changes in patients'

conditions, and most importantly, assists in facilitating optimal patient care outcomes for critically ill and injured patients.

Consequently, Registered Nurses wishing to practice in critical care must not only acquire but also retain a solid theoretical and practical knowledge base (Porte-Gendron, Simpson, Carlson, & Vande Kamp, 1997). However, little is known about the acquisition, or more importantly, the retention of basic critical care nursing knowledge in Registered Nurses after completion of critical care nursing education programs and entry into critical care nursing practice. Investigation into the acquisition and retention of basic critical care nursing knowledge, situational factors within critical care environments that might affect acquisition and retention of knowledge, and identification of a possible relationship between knowledge retention and job satisfaction in critical care nurses is of considerable significance. Without question, knowledge retention is a requirement for responsible, accountable, and professional performance (Caine, 1990).

Purpose of the Study

Learning is an interactive and dynamic process (Cust, 1995), and is believed to occur when experience causes a change in an individual's knowledge or behavior (Woolfolk, Winne, & Perry, 2003). Although the dissemination and acquisition of knowledge has been consistently identified as long-standing primary objectives of education programs (Myer, 1999; Rashotte & Thomas, 2002), failure to retain learned information has yet to become fully recognized as an important issue in the education process (Blumenfeld et al., 1998). In particular, the retention of basic knowledge following critical care nursing education programs has been no exception.

Critical care nursing education programs demand that learners acquire and retain large amounts of critical care information (Oermann et al., 1992). However, evaluative measurements of Registered Nurses during and at the completion of critical care education programs have predominantly employed subjective methods of student evaluation. Moreover, evaluative measurements of critical care nurses in critical care education programs have been inconsistent, highly variable, and most importantly, have frequently confused an evaluation of the learner with the nurse's satisfaction with the program.

The unpredictable nature of many critical care units may mean that the Registered Nurse, during a critical care nursing program, may not be exposed to the type and variety of learning experiences necessary to solidify and retain basic critical care nursing knowledge. Factors within the education experience itself may facilitate or adversely affect acquisition and retention of critical care nursing knowledge. Nurses who have successfully completed a critical care education program may also have noticed a tremendous difference between the learning pace of the classroom and the work pace of the critical care unit (Lauder, Reynolds, & Angus, 1999). Initial enthusiasm may disappear once classroom sessions have ended and the reality of clinical work confronts the newly trained nurse. Registered Nurses new to the critical care environment may become overwhelmed at the complexity of patient care conditions one is expected to manage. Disillusioned with their new role as a critical care nurse, frustration and job dissatisfaction may soon follow.

Technical skills of critical care nurses, such as familiarity with arterial lines, pulmonary artery catheters, and cardiopulmonary resuscitation have been the focus of

some investigation within nursing research. The examination of isolated skills (and knowledge) required of critical care nurses, however, does not accurately reflect the overall critical care knowledge required of nurses, in general, for independent critical care nursing practice. The acquisition of basic critical care nursing knowledge, but more importantly, the retention of basic critical care nursing knowledge of nurses following critical care nursing education programs, and an identification of factors that possess the ability to impact not only acquisition but also retention of that knowledge, including job satisfaction, has not been adequately investigated.

The purpose of this study was to investigate the acquisition and retention of basic critical care nursing knowledge among Registered Nurses who had completed an accredited, college-based, adult critical care nursing education program. The research questions that were addressed included:

1) Is there a difference in the basic critical care nursing knowledge scores of Registered Nurses at pre-, post-, and six months post-completion of an adult critical care nursing education program?
2) Is there an association between demographic characteristics, situational factors, and knowledge scores of Registered Nurses who have completed an adult critical care nursing education program?
3) Is there an association between knowledge retention and job satisfaction in Registered Nurses six months after the completion of an adult critical care nursing education program?

Significance of the Study

The aim of this study was to identify whether or not basic critical care nursing knowledge was acquired and retained among Registered Nurses who had chosen to participate in an adult critical care nursing education program. Second, this study sought to evaluate whether or not demographic characteristics of the nurses and/or situational characteristics of the critical care education experience affected acquisition and retention of basic critical care knowledge. Third, this study was an attempt to identify whether an association existed between Registered Nurses' retention of basic critical care nursing knowledge and job satisfaction six months after completion of a critical care nursing education program. Most importantly, this study may lead to suggestions for future research into knowledge acquisition, knowledge retention, and job satisfaction of critical care Registered Nurses following completion of adult critical care nursing education programs.

CHAPTER TWO

Literature Review

For the purposes of this study, a comprehensive review of nursing, medical, educational, psychological, and sociological databases, including Best Evidence, BioethicsLine, CINAHL, Cochrane Library, Educational Psychology, Embase, Eric, HealthStar, MedLine, PsychInfo, PubMed, SAM, and Web of Science, from 1980 to January 2004 (where applicable), was completed. Using these databases, research literature that related to the acquisition and retention of knowledge in the health care sciences, with particular emphasis on the retention of basic knowledge for critical care nurses, was identified and examined.

The Importance of Education in Nursing

The relative worth of an education depends largely upon the lifespan of what has been acquired and retained (Bahrick, 2000). Unfortunately, educators have often been preoccupied only with the immediate achievement of students, giving little consideration to the effects of instruction or courses on long-term retention of content (Bahrick, 2000). One of the greatest challenges facing health care educators today, including nursing educators, is how to ensure that nursing staff are competent (Broomfield, 1996).

Within nursing, it has generally been accepted that a minimum level of cognitive knowledge is necessary for overall nursing competence and safe nursing practice (Alberta Association of Registered Nurses, 2000). Highly competent performance is distinguishable from less competent performance by the extent and quality of background knowledge individuals bring to specific situations (Cust, 1995;

Hendricks-Thomas, Crosby, & Mooney, 1995). Competence encompasses not only knowledge gained from an education program, but also necessitates the capability of applying that cognitive knowledge efficiently and effectively while caring for patients who may present with simple or more complicated medical conditions (Ferrer Duller, 1995). Consequently, a delicate, complex inter-relationship exists between the acquisition and retention of one's cognitive knowledge base and subsequent acceptable performance of nursing skills (Whittaker & Henker, 1987).

One goal of nursing education has been to enhance the acquisition of theoretical (cognitive) knowledge necessary to problem solve (Clochesy, 1988; Kidd & Wagner, 1992; Myer, 1999; Rashotte & Thomas, 2002), and the ability to facilitate transfer of knowledge from the classroom to clinical practice (Lauder et al., 1999; Wigens & Westwood, 2000). Although some students possess the ability to effectively and efficiently grasp and utilize concepts that can assist in defining and solving one's problem, others experience difficulty and varying degrees of concept comprehension and/or proficiency in applying solutions to problems (Gagne, 1970). There is no guarantee that any two individuals who possess the required knowledge would be able to successfully apply that information in a particular problem-solving situation (Ausubel, 2000). Without the cognitive knowledge necessary, however, problem solving, or, at minimum, identification of changes in the patient's condition that would alert the nurse that a problem exists, would be difficult, if not impossible.

Nursing education ought not merely be a "fact-loading" process, but should also creatively stimulate curiosity among individuals to identify problems and demand understanding of the principles of rigorous and faithful inquiry (Kennerly, 1990).

Nurses should learn solid methodologies for selecting the best possible interventions, and more importantly, possess the capability of evaluating the effectiveness of those interventions (Grossman, Campbell & Riley, 1996). Subsequently, not only is the acquisition of basic nursing knowledge an important issue for both nursing educators and nursing students, but the retention of basic nursing knowledge is also of considerable importance. With this in mind, the knowledge necessary for initial Registered Nurse licensure, however, may vary greatly from the in-depth, technical, working knowledge necessary for more specialized areas within nursing, such as critical care.

Critical Care Nursing Education

Critical care nursing education evolved as a response to the development of critical care units in the late 1950's and early 1960's (Hoffman, 2001) and the perceived need to staff these specialized units with knowledgeable personnel (Caine, 1990; Ferrer Duller, 1995; Houser, 1977; Johantgen, 2001). The purpose of critical care nursing education is to facilitate the acquisition of a specialized body of unique critical care nursing knowledge that enhances the ability of both experienced and inexperienced Registered Nurses to function effectively and safely within critical care units (Ressler, Kruger, & Herb, 1991). The process of critical care nursing education has been well described in the literature (Alspach, 1982; Clochesy, 1988; Holloway, 1988; Kidd & Wagner, 1992; Kinney, Packa, & Dunbar, 1993; Thelan, Urden, Lough, & Stacey 1998; Woodrow, 2000).

Standards of critical care nursing practice have been identified by professional organizations (American Association of Critical Care Nurses, 1986; Canadian

Association of Critical Care Nurses, 1997). These standards of practice are grounded in the application of "basic" knowledge in the critical care setting (Toth, 1984; Whittaker & Henker, 1987). Although the presence of "basic" information does not assure safe, competent practice, safe practice cannot exist without some form of "basic" knowledge (Santiano, Daffurn, & Lee, 1994; Toth, 1984).

A general consensus exists within the literature as to what constitutes basic critical care nursing knowledge. Porte-Gendron et al. (1997), in a comparative survey design, asked a randomly selected national sample of baccalaureate nurse educators ($n = 41$) and critical care nurse managers ($n = 41$) to validate a list of critical care competencies expected of the novice baccalaureate nurse in adult critical care units. Educators and managers agreed on 81 of 105 competencies as "essential" or "desirable" for newly oriented critical care nurses. Knowledge about hemodynamic monitoring, cardiopulmonary resuscitation (CPR), arrhythmia interpretation, principles of ventilator management, oxygenation/ventilation, fluid and electrolyte disorders, and medications commonly used for critically ill patients in emergency situations, were identified as necessary competencies for beginning critical care nurses.

From a Canadian perspective one year earlier, Fitch, Eifert, Matthewman, Mosley, Pearce, and Williams (1996) surveyed critical care nurses ($n = 365$) to establish consensus on basic competencies in critical care nursing practice. Using a modified Delphi technique and a list of primary competencies, critical care Registered Nurses were asked to rate on a five-point Likert scale how strongly it was believed each listed competency was for nurses entering critical care practice. After four rounds of

surveys, the participants in this study identified 216 competencies as necessary for beginning critical care nurses. Knowledge about pathophysiology (pulmonary edema, respiratory failure, myocardial infarction), pharmacology (use of thrombolytic agents, intravenous inotropic medications), equipment (defibrillator, ventilators), technical and life support (basic arrhythmia and arterial blood gas analysis, suctioning of endotracheal tubes, maintenance of arterial lines) indicated strong overall agreement with the competencies subsequently later identified by Porte-Gendron et al (1997). More importantly, Fitch et al. reported that professional behaviors, such as prioritizing patient care, providing clear, concise verbal and written communication, recognizing one's limitations, knowing when to ask for help, and sound knowledge about concepts of critical care nursing practice, were also identified by this group of nurses as requisite abilities of critical care nurses.

Critical Care Nursing Education Programs

Traditionally, hospital-based orientation programs have been the means by which new staff members, including Registered Nurses, have been introduced to that particular organization's mission statement, philosophy, goals, policies, procedures, expectations, and physical layout of the specific work setting (American Nurses Association, 1990). This was based on the understanding that the required degree of basic knowledge and skill for Registered Nursing practice had been achieved as a result of successful completion of a basic diploma or baccalaureate nursing program. However, for the most part, basic nursing education today reflects the education and training of generalists, knowledgeable about health, illness, interventions, and treatments, familiar to primary and tertiary care settings (Kennerly, 1990).

The development of sophisticated medical treatment and technology, combined with the increasing complexity of patient care requirements, has necessitated re-evaluation of the purpose and function of traditional orientation programs for Registered Nurses (Boyle, Butcher, & Kenney, 1998), including critical care nursing programs. Although most critical care units have always provided some degree of additional training for newly-employed nurses (Alspach, 1995), the literature suggested that the amount and depth of information conveyed to nurses during orientation programs varies considerably depending upon the educational background of the educators, the learning needs of the Registered Nurse, the presence or availability of qualified staff to impart the required information, and more importantly, the needs of the critical care unit.

Consequently, reconceptualization of many traditional hospital-based and independent critical care education programs has occurred, and critical care education programs have become well-established in hospitals, community colleges, at university undergraduate levels (Hoffman, 2001), as post-basic certificate programs in educational institutions or by distance education (Price, 1993), or have been offered through private service providers (Alspach, 1990a). The lengths of critical care education programs have also been reported as highly variable, ranging from one (Roberts et al., 1986) to 24 (Marshall, 1993), to 36 weeks (Alspach, 1990a).

Most critical care education programs consist of both theoretical and clinical components (McKane & Schumacher, 1997). The didactic component of most programs is usually highly structured (Hartshorn, 1992), and may consist of lectures, group discussions, case study reviews, observations of procedures, demonstration of

new equipment, computer-assisted instruction, and independent study (Roberts et al., 1986). On the other hand, the clinical component of critical care education programs may be highly unstructured, and consist of a variable number of clinical hours and a "hodge-podge" of learning experiences. Introduction to the critical care unit during critical care nursing education programs may be facilitated through preceptorship (Caine, 1990), mentorship (Myer, 1999), sponsor roles (Carey & Campbell, 1994), co-assignment, or on-the-job training (Roberts et al., 1986).

Diversity in educational preparation has frequently characterized critical care program educators, individuals who have been responsible for the delivery of information in critical care education programs (Angel, Duffey, & Belyea, 2000). Unit-based clinical preceptors, clinical development nurses (CDN), clinical nurse specialists (CNS), and unit managers, individuals most frequently cited as being responsible for communicating and reinforcing critical care knowledge and skill to the orientee (Alspach, 1982; Hartshorn, 1992), may or may not be familiar with the knowledge or skills required of critical care nurses. In a survey conducted by the American Association of Critical Care Nurses (AACN) Education Standards Task Force (as cited in Alspach, 1990b), it was reported that 58% of nurse managers were responsible for nursing staff development. More surprising, however, was that 40% of these individuals had never taken an academic course in the field of education and 22% of these nurse managers had received no orientation whatsoever to their position as nursing educator.

Registered Nurses who have chosen to participate in critical care education programs also possess diverse educational backgrounds and a variety of experiences

(Rashotte & Thomas, 2002), which may or may not have helped prepare them for future practice in critical care. Nurses may be graduates of either diploma or baccalaureate degree programs, and may or may not have been exposed to the critical care environment as a student during initial training. Critical care orientees may be newly graduated from nursing school, possess previous experience in unrelated critical care areas such as medicine, geriatrics, oncology, or pediatrics, or may have worked in critical care many years ago.

In the last major investigation into critical care education programs in North America, Alspach (1990a) conducted a readership survey through a national critical care nursing magazine and obtained responses (n = 148) from 39 American states and one Canadian province regarding the current state of critical care education programs. Undertaken 14 years ago, results from this particular survey not only support current literature on characteristics of critical care education programs, but also strongly suggest that follow-up with Registered Nurses who have completed critical care education programs has been largely ignored.

Alspach (1990a) reported that the average duration of most critical care education programs was seven and one half weeks. The greatest number of respondents (n = 38, 26%) indicated that education programs primarily lasted six weeks, while the second greatest number of respondents (n = 29, 19.5%) reported critical care education programs lasted 12 weeks. Overall, 86 % (n = 128) of hospital critical care education programs were reported to be of variable duration.

Almost 80% (n = 117) of institutions reported knowledge of critical care orientees was assessed prior to enrollment in a critical care nursing education program.

However, only 31 responses (21%) acknowledged use of a formal method of pre-program evaluation, such as the *Basic Knowledge Assessment Tool (BKAT).* Other, more frequently reported methods of pre-assessment of nurses wishing to enter critical care nursing practice included personal interviews (n = 84, 57%), written checklists of knowledge and skill that would be required of the orientee (n = 83, 56%), pre-tests developed by hospitals (n = 53, 36%), and references from previous employers and/or managers (Alspach, 1990a).

Alspach (1990a) reported that Registered Nurses in critical care education programs were most often 20 to 29 years of age, and that the largest group of nurses in such programs were nurses with experience but new to critical care (43.7%), followed by nurses with previous experience in critical care (36.6%), and finally, new graduates (19.7%). Over one third (n = 54, 36%) of reporting organizations identified a mandatory requirement of one-year nursing experience before acceptance into a critical care education program. However, when shortages of critical care nurses and recruitment problems existed, pre-existing requirements for most critical care education programs were overlooked.

Individuals most frequently reported as being directly involved with planning of critical care education programs included head nurses (79%), critical care instructors (74%), preceptors (66%), and critical care staff nurses (45%). Almost 70% of critical care education was stated to have been imparted to Registered Nurses in the clinical setting, 25% in the classroom, and 5% in a simulated clinical lab. Only 40.5% (n = 60) of respondents had identified that critical care nursing instructors were available full time for teaching purposes, and 55% (n = 81) identified that critical care

educators also worked as staff nurses. The teaching method most often utilized in critical care nursing education programs was the traditional educational approach (n = 81, 55%), which included lecture, group discussion, and demonstration in the critical care unit (Alspach, 1990a).

Ninety five percent (n = 140) of hospitals acknowledged using preceptorship for education purposes, and most respondents (n = 113, 76%) indicated staff nurse preceptors were responsible for only one student at any given time. However, 76% (n = 112) of hospitals reported that a student's preceptor might change during the nurse's critical care education period, while 17% (n = 25) indicated that preceptors would change often. One-third of respondents pointed out that experienced critical care nurses had been given no formal education or training for their role as a clinical preceptor (Alspach, 1990a).

Most importantly, evaluation of a nurse's success in a critical care education program was highly variable between reporting institutions, and not all institutions chose to report how critical care programs were evaluated. Eighty-seven percent (n = 129) indicated that more than one evaluation tool was used to measure success in a critical care program, and most institutions (n = 129, 87%) relied upon a combination of both written tests and skill checklists to determine that nurses had successfully completed the critical care nursing program.

With regard to written examinations, only 23 (16%) of institutions indicated that statistical reliability and validity had been calculated for critical care examinations currently being used to evaluate nurses' knowledge. In other words, over two-thirds of critical care education programs employed multiple-choice examinations with no

known reliability or validity. Even less reported reliability and validity existed for skill checklists, primarily used to evaluate newly trained critical care nurses in clinical practice. Over half of respondents indicated that completion of a critical care education program was most often determined on the basis of the Registered Nurse achieving the required pass marks on critical care examinations, demonstrating specific performance criteria in the clinical setting (as evidenced by skill checklists), and adhering to the required policies and procedures of that particular institution (Alspach, 1990a).

Evaluation of Critical Care Nursing Education

Assessment of cognitive educational achievement among critical care nurses is mandatory if there is to be a flexible and dynamic work force in the future (Wigens & Westwood, 2000), and if there is to be any measure of Registered Nursing competence within critical care units. Although a significant amount of literature has been published reporting the success of individual critical care nursing programs, little effort has been directed at evaluating the long-term effectiveness of educational preparation for critical care nurses (Wigens & Westwood, 2000), and the long-term effects of such programs.

Evaluation of critical care nursing education and critical care nursing education programs has often become confused with an evaluation of critical care education program content, an evaluation of the learning environment, or an evaluation of learner satisfaction about the program. Post-program surveys that have assessed students' perceptions of education programs (Smith & Altieri, 1988), assessed nurses as to whether or not education programs had met expectations for theory and practice

(McKane & Schumacher, 1997), and educators' who have reported the number of nurses who have successfully completed critical care nursing education programs (Myer, 1999; Sakallaris, 1991), have all fallen short of objectively determining to what degree nurses had acquired basic critical care nursing knowledge. More importantly, these studies failed to address to what extent basic critical care nursing knowledge had been retained once critical care nursing education programs had concluded.

Critical care education programs that cover too much content are inefficient, and, programs that cover too little content are ineffective (Alspach, 1990b). If the education period is too short, the program may not provide sufficient opportunity for the learner to acquire the cognitive knowledge necessary. On the other hand, if the education period is too long, the nurse might fail to retain knowledge learned during earlier parts of the course. The acquisition and retention of basic critical care nursing knowledge may be affected by many factors, including the length of time provided for critical care education, one's familiarity with the clinical environment, quality of time spent training in clinical practice, and individual differences among Registered Nurses (Lauder et al., 1999).

The three most commonly used methods described in the literature to evaluate the success of critical care nursing education programs (and the Registered Nurses who have chosen to participate in such programs) are evaluation by clinical preceptors, "self-evaluations," and multiple-choice examinations. Acquisition and retention of basic critical care nursing knowledge, based upon the subjective evaluation of one or more clinical preceptors, has been an unreliable and inconsistent method of

evaluating newly trained critical care nurses. Although assessment of the newly trained critical care nurse by the preceptor is one of the most commonly used methods of evaluation during critical care education programs (Alspach, 1990a), standards of critical care knowledge deemed basic to one preceptor may be unacceptable to another. Moreover, knowledge content can and does vary among critical care preceptors. Bizek and Oermann (1990) examined the educational experiences, support, and job satisfaction among nurse preceptors (n = 73) in a large teaching hospital, and during the study it was unexpectedly discovered that 27 (37.9%) of the preceptors were unfamiliar with the content taught during their preceptees' critical care education program.

"Self-evaluations" have not provided an accurate or reliable method of determining knowledge acquisition, knowledge retention, or learner readiness for independent nursing practice. Smith and Hatchett (1992) investigated qualified nurses in England (n = 50) and surveyed the nurses' perceptions of competence in cardiopulmonary resuscitation (CPR) and cardiology skills. The authors reported that higher scores tended to be associated with activities nurses performed most often, such as placing the patient on a cardiac monitor (n = 40; 80%), identifying equipment for airway insertion (n = 33; 66%), and using atropine for sinus bradycardia (n = 30; 60%). Smith and Hatchett observed that there were significant cognitive knowledge deficits for nurses regarding initial choices of medication for patients experiencing cardiac conduction disturbances, despite self-appraisals to the contrary. The authors of this study did not investigate or suggest reasons why nurses may have over-estimated their perceived competence.

Registered Nurses may also be unwilling or unable to appraise themselves realistically, especially with regard to roles and responsibilities that they themselves believe they are expected to fulfill. Crunden (1991) measured Registered Nurses (n = 51) perceived and actual competence in performing cardiopulmonary resuscitation (CPR). Nurses were questioned whether or not they believed they could effectively perform CPR, and were then asked to demonstrate their resuscitation skills against standards identified by the Royal College of General Practitioners in England. Crunden observed that none of the 51 nurses were able to pass the skills portion of the test, and identified that nurses had inappropriately described their own skill level at the time of the test because of: (a) poor and sporadic refresher training; (b) the "role" that the nurses believed they were looked upon to fulfill; and (c) past experience of cardiac arrests. In this study, nurses had described that they were most influenced by what they were taught, when it was taught, by whom it was taught, but most importantly, how long ago the teaching had occurred.

Unit-specific multiple-choice examinations are frequently administered as principle methods of determining the degree of cognitive knowledge acquired during critical care nursing education programs. Factual and recall questions appear to predominate (Roberts et al., 1986), and passing grades of 70, 80, or 90% have most often been interpreted as indicators of cognitive learning (Grossman et al., 1996; Sakallaris, 1991).

Multiple-choice tests are most frequently administered during and at the conclusion of critical care education programs. Multiple-choice examinations can help identify knowledge that has been "acquired" or "failed-to-be-acquired" during

the program. Multiple-choice test items can be highly discriminating, accurately assess a student's ability to correctly apply concepts to clinically oriented situations (Morrison & Free, 2001), and more importantly, provide objective validation of the cognitive component of clinical competence (Alspach, 1995).

Unfortunately, most critical care education programs do not use any type of "standardized" examination as a method of evaluation (Hartshorn, 1992; Schempp & Rompre, 1986). As Alspach (1990a) observed, few multiple-choice critical care examinations have been subjected to any type of reliability and/or validity testing. Most examinations have often been developed, administered, and revised by individuals responsible for the delivery of critical care programs, and often based on specific needs of the particular critical care unit. Between institutions, tests can vary in both scope and depth of knowledge, and what has been deemed as sufficient for independent practice in one hospital may be viewed as suboptimal for independent practice in another.

At the conclusion of the North American Critical Care Educational Program Survey (Alspach, 1990a), respondents were asked to identify what was perceived to be the biggest problems associated with critical care nursing education programs. Although the three most frequently cited problems were a perceived lack of clarity in performance standards, a lack of consistency among preceptors, and that the duration of most critical care educational programs was too brief, only 12 institutions (8.1%) acknowledged that a significant issue was little or no follow-up with Registered Nurses after critical care nursing education programs had been completed. The need to objectively, effectively, and efficiently evaluate critical care nursing education, in

particular, the long term outcomes of critical care nursing programs, as well as factors that embody the potential to affect acquisition and retention of basic critical care nursing knowledge, is long overdue.

Evaluating Knowledge Acquisition in Critical Care Nursing

Researchers in three studies have identified that acquiring basic critical care nursing knowledge could occur as a result of participation in a critical care education program. Toth (1984) sampled senior baccalaureate nursing students ($n = 38$) at the beginning and end of a six-week senior elective critical care nursing course. The course consisted of 24 classroom hours and 60 hours clinical practicum, which were completed in intensive care, coronary care, medical/surgical intensive care, and a critical care burn unit. A comparison group of nurses ($n = 73$) with up to six years critical care experience was used as a control group. Cognitive knowledge acquisition was tested with the administration of the *Basic Knowledge Assessment Tool (BKAT)*, originally a 90-item multiple-choice examination used to measure basic critical care nursing knowledge. Although the comparison group of experienced critical care nurses had statistically significant higher scores on the exam, senior nursing students did demonstrate greater acquisition of critical care nursing knowledge (higher test scores) at the end of the program as compared to the pretest at the beginning of the senior elective course.

Oermann (1991) examined undergraduate nurses' ($n = 85$) acquisition of basic critical care nursing knowledge in response to a 14-week critical care nursing education program offered at a large midwest American hospital, and at the same time, evaluated the effect of different teaching methods on acquisition of critical care

knowledge. Two experimental groups consisted of lecture only (n = 18) and lecture and clinical components (n = 44); the control group (n = 17) of working critical care nurses did not participate in the program. Each group wrote the *BKAT-3 (Version 3)* examination on two separate occasions: at the beginning and end of the 14-week course. Subjects in both lecture (t = -4.62, p = 0.001) and lecture-clinical (t = -6.57, $p < 0.001$) groups significantly increased their test scores from pre-test to post-test, although t-tests revealed no significant difference in test scores between the two groups. When compared to the control group, results indicated that test scores for both experimental groups were significantly higher than the control group (p = 0.05), and significant differences in post-test scores existed among all three groups (f = 9.644, p = 0.0002). In addition, there were no significant differences in test scores based on method of content delivery or previous nursing experience. However, a statistically significant difference existed between nurses with previous critical care nursing experience compared to those who had no previous critical care experience.

Like Toth (1984) and Oermann (1991), Price (1993) compared a group of experienced and non-experienced Registered Nurse students (n = 38) enrolled in a 16-week critical care education program to a control group of practicing critical care nurses (n = 15) in a variety of adult critical care units. Both groups completed the *BKAT-4 (Version 4)* on the same days, at the beginning and end of the critical care program. Statistically significant differences in *BKAT-4* scores between the two groups at pre-test (t = 6.22, p = 0.0000) and post-test (t = 4.39, p = 0.0001) indicated that students in the critical care education program had significantly increased their knowledge base about critical care nursing. While students still scored lower on both

the pre-course and post-course examinations than did the practicing critical care nurses, it was reported that years of nursing experience ($r = 0.41$, $p = 0.0476$) and years of critical care nursing experience ($r = 0.62$, $p = 0.0001$) were found to be the best predictors of basic critical care nursing knowledge.

Evaluating Knowledge Retention in Critical Care Nursing

Assessment of knowledge acquisition, but more importantly, knowledge retention, represents one attempt to verify that learners have attained some degree of behavioral change (Gagne, 1970; Powner & Rogers, 1999). It has been well documented that knowledge retention amongst individuals declines over time (Ausubel, 2000; Farr, 1987; Gagne, 1970; Gagne, 1985; Gagne & Medsker, 1996). Researchers who investigated knowledge retention and trauma management skills among practicing physicians (Ali, Cohen, Adam, Gana, Pierre, Ali et al., 1996), and knowledge retention between trauma and non-trauma physicians following successful completion of Advanced Cardiac Life Support (ACLS) courses (Blumenfeld et al., 1998), both illustrated that periods of "non-use" gradually led to the decay of that knowledge or skill (Farr, 1987).

The initial "imprinting" of knowledge has been described as one of the most important parts of the learning process (Powner & Rogers, 1999), and an evaluation of learners after a given period of time since initial learning occurred would best assess the definitive impact of an educational experience (Ausubel, 2000; Powner & Rogers, 1999). In other words, the degree of original knowledge that had been retained would be best assessed after a reasonable length of time had passed since the original learning had occurred. However, evaluating retention of critical care nursing

knowledge has been difficult, particularly if a clear understanding about the concept of retention does not exist.

In one study, Kellmer-Langan, Hunter, and Nottingham (1992) evaluated retention of knowledge and application of clinical skills among nurses (n = 27) of two large western American hospitals following two 8-hour physical assessment workshops. Subjects were tested with identical knowledge tests and skill checklists at the beginning and end of the workshops, and, three months after the education sessions had been offered. Although Kellmer-Langan et al. failed to describe the nurses' previous exposure to physical assessment classes, whether physical assessment content related to newborn, pediatric, or adult populations, and whether or not the knowledge test had been subjected to any type of reliability testing, the authors reported that a significant increase in knowledge *retention* occurred at the conclusion of the workshops. Given that retention encompasses a period of time after which the original learning has occurred (Gagne, 1970), what should have been stated was that although a noticeable increase in knowledge *acquisition* from pre-program to post-program had occurred, there was also a noticeable decrease in knowledge *retention* three months later.

In another study, Schlomer, Anderson, and Shaw (1997) compared various teaching strategies to its effect on nurses' (n = 67) retention of occupational health, safety, and infection control knowledge following one 8-hour mandatory, yearly in-service. The control group of nurses (n = 35) was taught by traditional lecture method, while the treatment group (n = 32) was provided with self-learning packages. A 10-item "forced-choice" test was provided to all nurses at the end of eight hours.

While the authors reported that there were no significant differences in knowledge retention among post-program scores for either group based on methods of teaching ($f = 3.10$, $p = 0.052$), it was actually the *acquisition* of information, not the *retention* of knowledge, for which the authors had tested at the conclusion of the program.

Munro and Grap (2001) investigated critical care nurses' knowledge about the use of antibiotics in critical care. Critical care nurses ($n = 90$) with an average seven years experience in critical care, from six adult critical care units in a single academic medical center in the United States, participated in this study. A six-question multiple-choice examination objectively evaluated cognitive knowledge of the nurses. A 100mm visual analogue scale (VAS) subjectively evaluated knowledge, comfort level, and perception of the critical care nurses with their role in interpreting culture and sensitivity results, white blood cell (WBC) differentials, discussing test results with physicians, and explaining the rationale for antibiotic therapy. While critical care nurses in this study evaluated their knowledge, comfort level, and perceived role with regard to antibiotic therapy on the VAS at less than 50, knowledge scores revealed a mean of 53.8%. The authors reported that cognitive knowledge about antibiotic use in the multiple-choice examination was not correlated with educational preparation of the nurse ($r = 0.21$, $p = 0.06$), years nursing experience ($r = -0.21$, $p = 0.10$), or years critical care nursing experience ($r = 0.01$, $p = 0.96$).

In a pilot study that consisted of a convenience sample of practicing critical care nurses ($n = 68$) from six adult critical care units in two large teaching hospitals, McGhee and Woods (2001) sought to describe critical care nurses' knowledge of arterial blood pressure (ABP) monitoring. Of subjects who participated, demographic

data indicated 64 nurses had four years general nursing experience, 57 reported four or more years critical care experience, and 44 nurses reported measuring ABP at least three to four times per week. In a non-supervised setting, an 18-item multiple-choice examination was given to the nurses who, at the same time, were asked to rate their ABP monitoring skills and identify the learning experience that made the greatest contribution to their overall level of ABP knowledge.

McGhee and Woods (2001) reported that none of the 68 nurses achieved the passing mark of 66% on the written examination. The mean test score among subjects was 36.7%, while more than two thirds of nurses (n = 58, 85.3%) had considered their ABP skills to be competent. Twenty-three nurses (33.8%) identified that preceptorship provided during critical care orientation was the learning experience that had contributed the greatest amount of influence over their current knowledge level about arterial blood pressure monitoring. However, only 68 out of a possible 391 nurses agreed to participate in this study, which may not have accurately reflected the knowledge base that existed among the critical care nurses. Furthermore, in both the Munro and Grap (2001) and McGhee and Woods (2001) studies, there was no indication that the knowledge being tested in the critical care nurses had ever initially been presented to the learners during their critical care education programs.

Retention of knowledge about critical care skills and tasks may be the result of a combination of both previous experience and one's professional duty to perform that task. To assess cognitive knowledge on the pulmonary artery (PA) catheter, Iberti, Daily, Liebowitz, Schecter, Fischer, and Silverstein (1994) mailed a 37-question multiple-choice exam to 500 nurses who had pre-registered for a hemodynamics

workshop as part of a larger critical care conference. Participants (n = 216) returned completed exams on the first day of the conference, with 138 (64%) of respondents having indicated that they were primarily employed in critical care. Examination scores revealed a mean score among nurses of 48.5%. Higher test scores were observed to correlate with years of experience in critical care (p = 0.01), certification in critical care ($p < 0.001$), frequency of PA catheter use (p = 0.03), and exposure to and responsibility for repositioning and manipulating the PA catheter (p = 0.001). Interestingly, in this study, self-assessed adequacy of knowledge significantly correlated with higher test scores (p = 0.001). Unfortunately, the authors did not speculate what factors may have contributed to the overall low test scores. However, one possible explanation was that the *Pulmonary Artery Catheter Multicenter Study Questionnaire (PACMSQ)* had been developed by physicians from critical care, medicine, surgery, and anesthesiology to evaluate physicians' knowledge of PA catheters. As a result, this study may have tested concepts beyond those provided in basic critical care nursing education programs.

Critical care nurses knowledge of PA catheters was also evaluated by Burns, Burns, and Shively (1996) who administered a revised 31-question multiple-choice *PACMSQ* examination to critical care nurses (n = 168) who worked at 15 large urban hospitals in the southern United States. Demographic variables of critical care nurses including educational background, area of primary work, critical care nursing experience, and frequency of PA catheter use, were correlated with knowledge scores on the written examination and with self-assessed competence with PA catheters. While over 90% of respondents described their knowledge as adequate or exceeding

that required, the mean score on the written examination was 56.8%. Mean knowledge test scores positively correlated with years of critical care experience (f [2, 165] = 3.69, $p < 0.03$), frequent use of the PA catheter (f [3, 164] = 5.46, $p < 0.01$), certification in critical care nursing (f [1, 166] = 9.36, $p < 0.004$), and periodic reviews of PA catheter information (f [3, 164] = 5.46, $p < 0.01$). The authors recognized, however, that non-random sampling and lack of standardization of testing conditions were limitations of this study. Perhaps more importantly, neither the Munro and Grap (2001), McGhee and Woods (2001), Iberti et al. (1994), nor Burns et al. (1996) studies had conducted any type of baseline knowledge assessment prior to testing the critical care nurses who had volunteered to participate in these studies.

Although studies have predominantly focused on the knowledge associated with specific aspects of critical care nursing practice, the retention of knowledge following education and training programs in CPR and ACLS has attracted greater attention among researchers. In some of these studies, researchers have examined differences in CPR knowledge and skill retention among lay persons (Coleman, Dracup, & Moser, 1991; Weaver, Ramirez, Dorfman, & Raizner, 1979), between physicians, non-critical care Registered Nurses and the general public (Kaye & Mancini, 1986), and other researchers have made recommendations for improving CPR skill retention among health care personnel (Moser & Coleman, 1992).

Gass and Curry (1983), who examined retention of knowledge and skill in physicians and Registered Nurses following a standard one day basic life support CPR training program, concluded that different levels of knowledge retention might have occurred because of differences between medical and nursing training programs.

Physicians ($n = 6$) and Registered Nurses ($n = 12$) from a community hospital were each tested using three separate measures: a multiple choice examination on CPR, opportunity to demonstrate one minute of CPR on a "ResusciAnne" doll, and at the end of one minute, subjects were asked to provide self-assessment of one's CPR knowledge and skill. Participants were tested on both knowledge and skill immediately following the one-day program, six months and one year later. Overall, there was significant improvement in both knowledge and skill immediately after the training program for both groups ($p < 0.001$). At six months, the physicians retained an edge over the nurses in cognitive knowledge, while nurses had both a noticeable decrease in knowledge ($p < 0.01$) and an increase in the mean number of errors in their performance. At 12 months, there was a further observable decrease in skills among the critical care nurses ($p < 0.02$), but knowledge scores for both groups had returned to pre-program levels. At the time of initial training and six months later, no direct relationship between perception of knowledge and actual knowledge was found for either group. Although Gass and Curry suggested that physicians and nurses might require different CPR training programs, there was no discussion regarding the demographics of the study sample, or the number of times physicians and nurses had previously completed CPR certification and/or recertification. An attrition rate of 14 physicians and seven nurses over the duration of the year long study might also have impacted study findings.

With findings not unlike those of Gass and Curry (1983), Lewis, Kee, and Minick's (1993) study of nurses ($n = 73$) from high intensity areas, which included critical care and emergency, revealed cognitive knowledge of CPR was also

adequately retained but psychomotor skills were not. On a single testing day, a 25-item multiple-choice *American Heart Association (AHA) Heartsaver Examination* was given to participants. Each participant also demonstrated CPR on a "ResusciAnne" doll, which was graded with the 23-point *AHA One Rescuer (Adult) CPR Skill Checklist*. None of the subjects had any prior knowledge about the study, and none of the nurses were allowed any time for a review of information or practice with the doll. Although 69 nurses (94%) had been successfully certified in CPR within one year prior to the study, scores on the knowledge test ranged from 64 to 100 ($SD = 8.29$), while skill test scores ranged 35 to 100 ($SD = 14.74$). The authors indicated that nearly one-quarter of all nurses had incorrectly performed almost half of the skills required during CPR demonstration. In this study, the nurses' ages and years employed in nursing significantly correlated with cognitive knowledge scores ($p < 0.05$).

In another study that focused predominantly on the retention of knowledge after CPR education, Inwood (1996) investigated critical care ($n = 25$) and cardiac critical care ($n = 45$) nurses knowledge of CPR prior to, three months, and six months following a two-hour resuscitation workshop with a nine-item multiple choice examination. As part of this study, nurses were also assessed as to whether or not they felt confident performing CPR, artificial respiration, and interpreting cardiac dysrhythmias. Workshops consisted of an update on CPR knowledge, demonstration on a "ResusciAnne" doll, and opportunity for nurses to practice CPR skills. Knowledge levels of both groups of critical care nurses increased as a result of the workshop, and Inwood observed there was no noticeable deterioration in knowledge

of the nurses at either three or six months post-workshop. In addition, while confidence in skills showed an increase over time, confidence in interpreting cardiac rhythms decreased for both groups, allowing Inwood to conclude that some type of relationship between confidence and active participation in CPR existed. Unfortunately, this study was characterized by a large attrition of nurses from the study (less than one half cardiac nurses remained at six months), and failure to describe impact of the demographic information on test results. Perhaps most notable from this study was that during the initial knowledge assessment, less than 40% of nurses were aware of current standards for treating ventricular fibrillation.

On the other hand, a gradual decline in retention of ACLS knowledge among critical care Registered Nurses was reported in two separate studies by Anthonypillai (1992) and O'Steen, Kee, and Minick (1996). Anthonypillai (1992) compiled a set of 16 questions that were asked during a structured interview to evaluate retention of ACLS knowledge of critical care nurses' (n = 18). All nurses held Intensive Care Nursing Certificates, and all had been recertified at least once in ACLS, three months to four years prior to participating in this study. Results indicated that critical care nurses who had most recently completed ACLS certification and/or recertification achieved the highest scores on interview questions. However, irrespective of when certification had occurred, most nurses answered 50% or less of questions correctly.

O'Steen et al. (1996) also demonstrated a decline of cognitive knowledge in a convenience sample of Registered Nurses (n = 40) employed in critical care, emergency, coronary critical care, and telemetry units, who completed the 50-item multiple-choice *AHA ACLS Test* on a single testing day. All of the nurses had been

successfully certified previously in ACLS, between 0 to 1,034 days prior to the study, with an average of 344.45 days. In this study, only 13 of 40 nurses had retained the ACLS knowledge necessary to pass the multiple-choice exam. Most reduction in ACLS knowledge occurred in this sample during the first 12 months after certification. O'Steen et al. also reported that of all the demographic variables examined, only the number of ACLS courses previously taken and years of experience in the specialty area were significant factors in predicting ACLS scores ($p = 0.01$).

At the same time, knowledge retention among critical care Registered Nurses remained at equivalent levels in two separate studies of Advanced Life Support (ALS) undertaken by Young and King (2000) and Hammond, Saba, Simes, and Cross (2000). Young and King (2000) examined knowledge and skill retention of critical care nurses ($n = 10$) at six and 12 weeks post-ALS instruction. Knowledge was assessed using 23 structured interview questions, used by researchers in an attempt to prevent subjects from consulting and utilizing textbooks to help with examination questions. Practical skill was evaluated by use of a structured observational checklist with 13 essential skill points. The overall pass mark of 84%, a combination of both knowledge and skill tests, was achieved by all nurses initially, by four nurses at six weeks, and only one nurse at 12 weeks. While it was reported that practical skill had a greater rate of decline than knowledge scores over the period of time that the study occurred, knowledge scores, which had initially declined from original training to six weeks post-training, remained stable between six and 12 weeks. However, Young and King failed to describe the marks achieved by the nurses' at the time of the initial

training, which made evaluation of the degree of knowledge acquisition and retention difficult.

Hammond et al. (2000) also examined ALS theoretical knowledge and practical skill of nurses ($n = 40$) who actively worked in critical care, coronary care, emergency, and cardiothoracic critical care units. A two day advanced ALS course was offered to nurses, who had all been sent an ALS study package four weeks pre-program. Cognitive knowledge of the nurses was tested immediately post-program and 18 months later, using a 90-item examination that consisted of 80 true-false questions and 10 ECG rhythm recognitions. Although all nurses passed the practical component of the study on both occasions, 36 nurses (90%) required verbal clarification from researchers while demonstrating skills on the practical component of the test during the second testing period. On the other hand, examination scores had increased from 81.7% ($SD = 5.68$) immediately post-program to 83.8% ($SD = 4.59$) 18 months later, but these increases were not statistically significant. However, as in the Young and King (2000) study, theoretical ALS knowledge remained at an equivalent level for these critical care nurses since education programs had ended.

Evaluating Retention of Basic Critical Care Nursing Knowledge

Although investigation into retention of specific aspects of critical care nursing practice has made important contributions to research and nursing practice, retention of overall basic critical care nursing knowledge following critical care nursing education programs has rarely been investigated. Few studies have examined the long-term effects of critical care nursing education programs on critical care

Registered Nurses.

Lanford (1989) analyzed variables associated with basic critical care knowledge of Registered Nurses ($n = 40$), employed by five different American hospitals (four community and one county hospital). Nurses wrote the *BKAT-3 (Version 3)* and *Demographic, Education, and Experience Questionnaire (DEEQ)* one year after graduation from their basic nursing program. Scores on the *BKAT-3* were analyzed according to type of basic nursing education, length of time since graduation, type of nursing experience, and completion of a post-graduation critical care course, to determine whether these variables had affected retention of basic critical care nursing knowledge. The type of basic nursing education made no difference in mean *BKAT-3* scores, but the length of time since the nurses' graduated demonstrated a significant difference ($F = 61.94$, $p = 0.048$). Nurses who had completed a course after graduation had the highest mean scores. Completion of a post-graduate critical care course resulted in the highest significant difference in mean scores ($F = 7.60$, $p = 0.000$), while students who had subsequently become employed in critical care after graduation scored higher than medical-surgical nurses. However, nurses had written the *BKAT-3* on only one occasion, and not all nurses who had participated in this study were employed in critical care.

Toth (2003) examined basic critical care nursing knowledge between nurses ($n = 682$) from the United States and several different countries, using the *BKAT-5 (Version 5).* American critical care nurses ($n = 528$) were compared to critical care nurses from Australia, Brazil, Canada, Grenada, Israel, and Thailand ($n = 154$). Mean scores for the American nurses were 85.8% ($SD = 8.1$), with a range between 46 to

100%. On the other hand, nurses from the foreign countries had a mean score of 81.7% ($SD = 11.2$), with a range between 35 to 98%. Although Canadian nurses scored higher than American nurses and higher than critical care nurses from all other countries, this result was not statistically significant. The number of years worked in critical care (F [1,6,] = 72.9, $p < .001$) accounted for the large difference in test scores. Toth concluded that years worked as a critical care nurse had remained good predictor of basic critical care nursing knowledge. Toth recognized, however, that differences in English comprehension between American and foreign trained critical care nurses, as well as terminology used on the *BKAT-5,* may have affected the results and contributed to lower test scores for nurses from other countries.

Ressler et al. (1991) evaluated knowledge retention among three groups of nurses, over a one-year period of time, following a critical care nursing internship program. Knowledge retention and job performance were compared among newly graduated nurses ($n = 24$), nurses with previous experience in medicine/surgery but no past critical care experience ($n = 35$), and nurses with previous critical care experience ($n = 25$), and were evaluated using the *BKAT-3 (Version 3)* and a unit-specific performance evaluation tool. Newly graduated nurses' wrote the *BKAT-3* prior to and at the end of the six-month internship program, and again at one year. The other two groups of experienced nurses wrote the *BKAT-3* at the beginning of their education, again at six months, and one year following the critical care nursing program. All of the nurses required a grade point average of >3.0 to be accepted into the internship program. Five-month job performance evaluations, which examined the difference in the number of errors made by each nurse (through anecdotal and incident reports) was

not statistically significant between the three groups. With regard to theoretical knowledge, newly graduated nurses scored higher than the other two groups of nurses on all *BKAT-3* examinations ($p < 0.01$). At six months, the nurses with medicine/surgery experience scored lowest ($p < 0.05$), but one year after completing the critical care education program, there was no statistically significant difference between the mean scores of any of the three groups.

In the Ressler et al. (1991) study, however, the theoretical and practical components of the education internship program were remarkably different between the groups. The newly graduated nurses were provided with a six-month internship that consisted of both theory and 60 preceptored clinical shifts. At the time of writing the *BKAT-3* for the second time, the newly graduated nurses had only just completed their education program; in other words, the authors had only measured knowledge *acquisition* of the new graduates at six months. Conversely, the experienced nurses received a six-week condensed version of the critical care nursing education program, received only two weeks of lecture (with remaining content requiring independent self-study), and an unspecified duration of clinical time. As suggested by Gass and Curry (1983), differences in education programs (for example, length of time offered for critical care education and nature and quality of training periods) may have been partly responsible for test score differences in knowledge retention between these three groups of nurses.

Wynd and Gotschall (2000) evaluated the design of a critical care nursing residency program created for a large army combat support hospital in the midwestern United States. The authors, in a quasi-experimental, descriptive

correlational design, examined knowledge attainment, perceptions of critical care nursing, and professionalism between two groups of army nurses: critical care nursing course participants (n = 27) and a control group of nurses (n = 30) who worked in the same hospital but were not enrolled in the critical care program. Part I of the program consisted of 96 hours of instruction over eight months (one weekend per month); Part II consisted of 320 hours of critical care clinical experience. Knowledge attainment was assessed using the *BKAT-4 (Version 4)*, perceptions of critical care nursing were measured with the *Perceptions of Critical Care Nursing Questionnaire (PCCNQ)*, and professionalism measured by *Hall's Professionalism Inventory*. Data were collected from both groups of nurses on three occasions: pre-program, post-program (at eight months), and six months post-program.

Mean age of the participants in this study was 41.06 years (SD = 6.29), mean years experience as a Registered Nurse was 13.41 (SD = 8.26), mean years military service was 9.11 (SD = 5.67), and mean years critical care nursing experience was 3.15 (SD = 5.04). Perceptions of critical care nursing increased significantly for the critical care group as a result of participating in the critical care program. No significant difference existed between groups on professionalism scores at any time during the study. There was a statistically significant increase in knowledge attainment scores for the critical care group post-program (f = 9.65, p = .003) and six months post-program (f = 13.98, p = .001). Knowledge attainment was positively correlated with nurses' who had participated in the critical care nursing course (r = .053, p = 0.000) and with years of experience in critical care nursing (r = .293, p = .013). Wynd and Gotschall acknowledged, however, that an attrition rate of 15% had occurred over

duration of the study. As well, nurses in the critical care group had been pre-selected for the critical care program based on their previous critical care experience. Similarly, the control group of nurses included an unspecified number of individuals who also possessed previous critical care nursing experience. Furthermore, the clinical component of the program had not been completed when nurses wrote the *BKAT-4* six months post-program.

Factors Affecting Knowledge Retention in Critical Care Nurses

During the period of initial learning in a critical care nursing program, the newly trained critical care nurse encounters a number of factors that have the potential to affect the acquisition and retention of basic critical care nursing knowledge. Moreover, in the first three to six months after completing critical care nursing education and entering critical care nursing practice, the Registered Nurse experiences a period of major professional growth (Houser, 1977). During the period of initial training and in the period of time after which the formal instruction has concluded, Ausubel (2000), Bahrick (2000), Farr (1987), Huckabay (1980), Gagne and Medsker (1996), and others have suggested internal cognitive structures might be influenced and affected by external events. A definitive relationship of situational factors of the critical care nursing education experience to the retention of basic critical care nursing knowledge has not yet been established.

Characteristics of Critical Care Nurses

Prior knowledge is a tool for learning (Cust, 1995; Dochy, Moerkerke, & Segers, 1999), and the knowledge, skills, and ability that each Registered Nurse brings to the critical care nursing education program may influence the degree to which new

material is both acquired and retained (Cooper & Libby, 1997). Prior knowledge, a combination of both previous education and practical experience, can have beneficial effects upon the ease with which new material is learned (Gagne, 1985; Angel et al., 2000), but this may not always occur. The degree to which prior knowledge and practical experience could interfere with the acquisition and subsequent retention of knowledge, however, remains uncertain (Ausubel, 2000). For example, both McCloskey and McCain (1988) and Price (1993) identified previous nursing experience to be the best predictor of basic knowledge among Registered Nurses completing an adult critical care education program. On the other hand, Toth (1986) described no significant relationships existed between *BKAT* test scores and age, educational preparation, length of time employed as a Registered Nurse, length of non-critical care nursing, or type of critical care unit where the Registered Nurse was employed. Duration of critical care employment, however, has been an excellent predictor of basic critical care nursing knowledge (Toth & Ritchey, 1984; Toth, 2003).

Degree of Original Learning

An important influence on the long-term retention of knowledge among individuals is the degree of original (initial or baseline) learning (Bahrick, 2000; Farr, 1987; Fleishman & Parker, 1962) that has occurred. It is essential that critical care nurses, during the time enrolled in a critical care education program, have acquired an understanding of the basic concepts of critical care nursing practice. As a result, the degree to which newly presented material has been originally learned will ultimately influence retention of that content (deYoung, 1990).

In general, there has been no guarantee that any two individuals will have acquired the same degree of learning from the same experience (Alspach, 1982). Problems can occur during coding and storage of cognitive knowledge and knowledge related to psychomotor skills, which may increase the likelihood that individuals are unable to locate and retrieve the knowledge when it is required (Lauder et al., 1999). Therefore, unless it can be demonstrated that the learner has first acquired the original content, it would be difficult to measure the degree of knowledge retained. Measuring the degree of original learning that has occurred assists not only in identifying whether or not the goals of the education program have been achieved (Alspach, 1995), but also in discovering whether or not a relationship between original learning and retention of basic critical care nursing knowledge exists.

Situational Factors of the Critical Care Education Experience

'Preceptorship,' 'Opportunity for Practice,' and 'Feedback' (verbal, non-verbal, and written form), are three significant yet interconnected pieces of the critical care education experience for Registered Nurses. However, the effects of preceptorship, opportunity for practice, and feedback on the acquisition and retention of basic knowledge of students in critical care education programs has not been determined.

The process of preceptorship in critical care education has been well described in the literature (Johantgen, 2001; Wigens & Westwood, 2000; Wright, 2002). The preceptor's knowledge of the teaching and learning process, expertise in providing the right amount of education and support, and one's prior learning experiences (Wright, 2002), will unquestionably vary among all critical care nurse preceptors. The establishment of a quality, working relationship, however, between preceptor and

student is crucial for success within critical care nursing education programs (Wigens & Westwood, 2000).

Nurses must be able to apply classroom theory to an infinite number and variety of clinical situations (deYoung, 1990), and critical care nurses are no exception. Learning experiences provided in the work setting exist for the purpose of assisting staff to perform their assigned duties and maintain competency in their job (Roberts et al., 1986). A given amount of practice yields enhanced understanding, memory, and knowledge (Cooper & Libby, 1997), especially if practice periods have been distributed over a longer period of time (Ausubel, 2000; Bahrick, 2000). Repeated practice, and the ability to practice under different learning conditions, has constituted a fairly reliable means for enhancing the acquisition and retention of both knowledge and skill over time (Bahrick, 2000; Gagne & Medsker, 1996; Huckabay, 1980). Not all individuals, however, will receive the same amount, quality, and/or frequency of practice (Farr, 1987), and the greater the period of non-use of learned knowledge, the greater the rate of knowledge decay (Farr, 1987).

Similarly, practice without feedback is meaningless. Feedback, either written, verbal, or nonverbal in nature, conveys to the learner clearly and concisely the degree to which the learner's performance approaches some standard (Gagne, 1985). Feedback may arise from within the individual as a result of participating in a particular experience, or may be provided by an outside source (Cooper & Libby, 1997).

Feedback should be both positive and encouraging (Huckabay, 1980), occur frequently (Gagne, 1985), and provide the individual with enough information to

understand and correct fundamental mistakes (Farr, 1987). As identified in Oermann's (1991) study, preceptors may be unfamiliar with information presented in the critical care class. Some preceptors may hesitate to provide feedback; others may provide only positive feedback, even when negative feedback is warranted (Quinn, 1995). The student's ability to detect subtle clues and indications from what the preceptor says and does, the ability to "read" what others are trying to tell the individual, the behavior of others, assimilation of feedback with existing nursing knowledge, and one's own reflection of the events taking place (Huckabay, 1980), are several important types of feedback that have the ability to impact knowledge acquisition and knowledge retention in critical care nursing practice.

Overall Satisfaction with Critical Care Education Program

The degree of original learning that nurses have acquired as a result of participating in critical care nursing education programs may be potentially influenced not only by demographic characteristics (for example: age, previous nursing experience, and length of time employed in critical care), but also by prior knowledge, degree of original learning, satisfaction with one's preceptorship, opportunity for practice, and quality of feedback. As well, the nurses 'Overall Satisfaction' with the education program itself may affect acquisition and retention of basic critical care knowledge among Registered Nurses in critical care programs.

Evaluation of learner satisfaction with education programs, a gauge of one's happiness with the program, content, and manner in which it was implemented (including clinical experiences), has been a necessary component of all critical care education programs (Alspach, 1995). However, learner satisfaction with critical care

nursing programs has often been used inappropriately in studies to illustrate the success of critical care nursing programs. Although Registered Nurse satisfaction with critical care education programs is an important part of the evaluation process, no researcher has attempted to identify a relationship between critical care education program satisfaction and retention of basic nursing critical care nursing content.

Job Satisfaction In Critical Care Nursing

Job satisfaction is a multifaceted and complex phenomenon (Slavitt, Stamps, Piedmont, & Hasse, 1978; Stamps, 1997). Job satisfaction among nurses has been described in the literature in relation to numerous factors, including organizational climate (Gilles, Franklin, & Child, 1990; Snarr & Krochalk, 1996), managerial style (Lucas, 1991), nurse retention (Price, 2002), and increased productivity and autonomy (Fung-Kam, 1998; Snarr & Krochalk, 1996).

Critical care nurses have frequently been the subject of investigations into job satisfaction. Dear, Weisman, Alexander, and Chase (1982), who investigated the effect of critical care nursing on job satisfaction and nursing turnover between critical care and non-critical care nurses, reported that critical care nurses were more highly satisfied with their work than non-critical care nurses ($p = .05$). Job dissatisfaction among critical care nurses has been identified as being correlated with staff turnover (Dracup & Bryan-Brown, 1999), absenteeism (Williams, 1990), accidents at work, altered job expectations, illness, and poor performance (Stechmiller & Yarandi, 1992). Moreover, several authors have postulated that basic critical care nursing education may influence job satisfaction (Houser, 1977; McCloskey & McCain, 1988; Oermann, 1991; Oermann et al., 1992; Price, 1993; Toth & Ritchey, 1984).

However, no researcher has attempted to evaluate whether a relationship between retention of basic critical care nursing knowledge and job satisfaction exists.

According to Oermann (1995), critical care education at the undergraduate level did not appear to influence job satisfaction. In this descriptive study, Oermann evaluated employment patterns and impact of a critical care course on job satisfaction, and compared job satisfaction between Registered Nurses who had completed the critical care nursing course with those who had not. Participants from 10 hospitals in the American midwest included nurses ($n = 42$) who had completed a critical care education course as part of their undergraduate degree, and practicing critical care nurses ($n = 59$) who had not taken the program and served as the control group. The 14-week critical care nursing course consisted of 28 lecture hours and 112 clinical hours. The *Index of Work Satisfaction (IWS) Questionnaire* was a two-part scale used to measure the overall importance and current level of satisfaction of six different components of a nurse's job: 'Pay,' 'Autonomy,' 'Task Requirements,' 'Organizational Policies,' ' Professional Status,' and 'Interaction.' Most of the nurses in this study ($n = 33$, 78.6%) were newly graduated and had entered critical care as their first area of nursing employment. Overall, there were no reported differences in total job satisfaction between graduates of the course and the control group of nurses. Both groups of nurses were least satisfied with 'Pay' and most satisfied with 'Interaction' with others. There was no correlation between the two groups for total job satisfaction, years of experience as a Registered Nurse, or years of experience in critical care.

No observable difference in job satisfaction was reported by Oermann and Bizek

(1990) among critical care Registered Nurses who had received education for their role as preceptor and those who did not. In a descriptive correlational study, these authors utilized the *IWS Questionnaire* to examine job satisfaction among critical care preceptors ($n = 73$) working both intensive care and step-down critical care units, at 10 teaching hospitals in the midwest United States. Critical care preceptors had a mean age of 30.7 years, a mean of 8.3 years nursing experience, a mean of 5.8 years experience critical care nursing, and a mean 2.5 years experience as a critical care preceptor. Critical care nurses who had received education for preceptorship did not report significantly greater job satisfaction than those nurses who did not receive training for preceptorship. Critical care preceptors were most satisfied in terms of prestige and status associated with one's position as a preceptor, and least satisfied with their pay. Preceptor nurses working "step-down" critical care units and "intermediate" care units were more satisfied with their jobs than preceptors working critical care (t [68] = .252, $p = .014$). A weak but significant negative correlation was found between job satisfaction and years of experience as a critical care nurse ($r = -.210$, $p = 0.041$). As the length of time spent in critical care increased, the lower the nurses' job satisfaction. In other words, in this study, time spent as a critical care nurse rather than the length of time in nursing or as a preceptor, was significant in terms of critical care nurses' job satisfaction. Furthermore, it was reported that critical care nurse preceptors identified that benefits to being a preceptor included the ability to teach and influence others (89%), increase one's own knowledge base (79.5%), and being able to keep current and stimulated (79.5%).

Baggs and Ryan (1990) analyzed critical care nurse-physician collaboration in a

descriptive study conducted over six months at a large northeastern United States medical center. Critical care nurses ($n = 68$), with a mean age of 31.8 ($SD = 5.7$), who had worked as Registered Nurses for a mean 9.6 years ($SD = 5.8$) with a mean 4.4 years critical care experience ($SD = 5.5$) were surveyed with the *IWS Questionnaire* and the *Collaborative Practice Scales*, which measured the amount of perceived collaborative practice between nurses and physicians in the critical care unit. A significant correlation was found between collaboration and satisfaction in decision-making, and in regard to transfer of patients from critical care to other areas in the hospital ($r = .67, p < .05$), but no relationship existed between those nurses who practiced more collaboratively and their perceived level of job satisfaction.

Norbeck (1985) examined the relationships among the perceived stress of one's job as a critical care nurse, job satisfaction, and psychological symptoms, and sampled critical care Registered Nurses ($n = 180$) from 18 different critical care units in eight hospitals throughout the western United States. The predominantly female (91%) sample ranged in age from 21 to 60 years, had a mean 7.5 years nursing experience with a mean 4.6 years employment in critical care nursing. Critical care units were a mixture of subspecialties, and nurses participating in this study were assigned two critical care patients on a regular basis. Four instruments, the *Nursing Job Satisfaction Scale*, *Questionnaire of Stressful Factors in the Intensive Care Unit*, *Brief Symptom Inventory*, and *Global Severity Index*, were mailed to the nurses. It was reported that years in nursing significantly correlated with job satisfaction and psychological symptoms, nurses with less experience and those who worked night shifts were more likely to experience job dissatisfaction, and that perceived job stress

was related to lower levels of job satisfaction ($r = -.24$, $p = .001$), and higher levels of psychological symptoms ($r = .33$, $p = .000$). Norbeck also identified that the aggregate of elements typically descriptive of the nature of critical care nursing (for example, number of celeritous decisions required, cardiac arrest situations, and the degree of knowledge required by the critical care nurse) ranked high as a stressor for critical care nurses, but was not significantly related to low job satisfaction.

Summary

Few researchers have investigated knowledge retention among Registered Nurses following education programs, including critical care nursing education programs. Researchers have tended to focus primarily on one or more specific aspects of critical care nursing practice, such as antibiotic therapy; technical procedures commonly undertaken for critically care patients, such as arterial lines or PA catheters; or knowledge and one's ability to accomplish a specific skill performed by critical care Registered Nurses, such as CPR.

Assessment and evaluation of the retention of basic critical care nursing knowledge is of crucial importance, as critical care patients frequently present with one or more body system failures. Changes in critical care patients' conditions, which may be very subtle or overt, necessitate rapid identification by the Registered Nurse, immediate communication of such changes to the critical care physician, and the know-how to carry out treatment as directed by medical staff. The ability to implement such treatment, but more importantly, the capability of evaluating the patient's response to treatment cannot occur unless some degree of basic critical care nursing knowledge has been retained and is present.

A review of contemporary health care literature has identified that an incomplete and fragmented picture of the issue of acquisition and retention of nursing knowledge, in particular of basic critical care nursing knowledge, exists. A general identification of the issues that surround the question of investigating knowledge retention among critical care nurses can be gleaned from the literature, but few reliable and valid studies have been conducted to investigate this phenomenon. No previous study has attempted to link knowledge retention and job satisfaction in critical care nurses.

CHAPTER THREE

Method

The purpose of this study was to evaluate basic critical care nursing knowledge at the beginning of a 15-week critical care nursing education program (CCNEP), the acquisition of critical care nursing knowledge at the end of the program, and the retention of basic critical care nursing knowledge six months post-program. In addition, at the end of the program, nurses were asked to identify the degree to which they believed 'Preceptorship,' 'Opportunity for Practice,' 'Feedback,' and 'Overall Satisfaction' with the CCNEP helped facilitate their learning. Six months later, nurses were evaluated on job satisfaction, to determine whether a relationship between knowledge retention and job satisfaction existed.

Design

A descriptive correlational design with repeated measures was used to examine acquisition and retention of basic critical care nursing knowledge among Registered Nurses following completion of an adult CCNEP. Registered Nurses enrolled in the on-site (Edmonton) Level I Advanced Studies in Critical Care Nursing Education Program, as offered by Mount Royal College, had their baseline critical care nursing knowledge assessed at the beginning (Phase 1, P1), at the end (Phase 2, P2) of the 15-week program, and six months after completion of the program (Phase 3, P3), with the *BKAT-6* (Toth, 2001). Demographic characteristics were assessed at baseline using the *Demographic Characteristics Data Sheet* (see Appendix A), and situational factors of the critical care learning experience were evaluated at the end of the program using the *Situational Factors Data Sheet* (see Appendix B). Each nurse's

theory (course) grades and grade from the final clinical practicum experience was obtained from Mount Royal College and compared to *BKAT-6* scores at 15-weeks. Six months after completing the CCNEP, job satisfaction of the nurses' was assessed using the *Index of Work Satisfaction (IWS) Questionnaire* (Stamps, 1997; Stamps, 2001)(see Figure 1). Because of copyright restriction, the *BKAT-6* examination and *IWS Questionnaire* are not included in the appendix of this study.

	MEASURE		
	BASELINE	15 WEEKS	6 MONTHS
VARIABLE	Pre-CCNEP Program	Post-CCNEP Program	6 Months Post-CCNEP Program
Demographic Characteristics	X		
BKAT-6 (Version 6)	X	X	X
CCNEP Theory (Course) Grades		X	
CCNEP Clinical Grades		X	
Situational Factors		X	
Index of Work Satisfaction			X

Figure 1 Research Design

Definition of Terms

Basic Critical Care Nursing Knowledge: The body of knowledge beyond that information required for initial nursing licensure (Toth & Dennis, 1993), and represents minimal knowledge necessary for Registered Nurses who have elected to enter critical care practice (Toth & Ritchey, 1984), as measured by the *Basic Knowledge Assessment Tool, Version 6 (BKAT-6)*, for critical care Registered Nurses

(Toth, 1984).

Demographic Characteristics: Age, gender, highest level of nursing education, previous nursing experience, length of time employed as a Registered Nurse, previous exposure to critical care, and previous critical care education courses/programs, as recorded on the *Demographics Characteristics Data Sheet* (see Appendix A).

Theoretical (Course) Grade: A singular numerical value, calculated as a percentage out of 100, which reflected a composite of four grades obtained by each nurse in the critical care nursing program, in physiology, pathophysiology, physical assessment, and pharmacology.

Clinical Practicum Grade: A singular numerical value, calculated as a percentage out of 100, which reflected the score achieved by each nurse in the final clinical (practical) component of the critical care nursing program.

Situational Factors:

- *Preceptorship* – a strategy whereby new employees are trained with the assistance of experienced staff nurses who serve as clinical instructor, role model, and resource for new staff members (Diehl-Oplinger & Kaminski, 2001), as nurses become familiar to the clinical setting, and a system whereby all components of the nursing process (assessment, planning, implementation, and evaluation) are actively used in helping students achieve learning needs and experiences (Johantgen, 2001);
- *Opportunity for Practice* - the provision of an experience with constant or several versions of the same or different tasks (Bahrick, 2000), which provides the conditions under which to apply and gain theory (Cooper &

Libby, 1997), with the ultimate goal of improved performance (Bahn, 2001);

- *Feedback* - information that learners receive about their own performance which enables an individual to compare one's actual performance with that of a standard performance (Huckabay, 1980), and may be verbal, non-verbal, or in written form;
- *Overall Satisfaction (with the Critical Care Education Program)* – the learner's overall contentment with the critical care nursing education experience (Alspach, 1995), as measured by the *Situational Factors Data Sheet* (see Appendix B).

Job Satisfaction: One's affective reaction to the multiple phases of one's work environment (Snarr & Krochalk, 1996); in other words, the nurse's level of contentment with his or her own work situation (Bizek & Oermann, 1990), as measured by the *Index of Work Satisfaction (IWS) Questionnaire* (Stamps, 1997).

The Mount Royal College Critical Care Nursing Education Program

The Mount Royal College Level I Advanced Studies in Critical Care Nursing is an accredited college program. An extension of the distance delivery critical care education program offered year-round by Mount Royal College, the Edmonton on-site program was an intensive 15-week theoretical and clinical program offered in September 2002 and February 2003 for those Registered Nurses who had applied for and been accepted into critical care nursing units within the Capital Health Region.

The goal of the CCNEP program was to facilitate and provide opportunity for nurses to acquire the skill, attitude, and basic critical care knowledge required for critical care nursing. By completion of the program, it was expected that each

Registered Nurse would be able to assume safe, independent care of a hemodynamically stable, mechanically ventilated, adult patient within the critical care unit (L. Slater-MacLean, personal communication, June 28, 2002). Goals of the Mount Royal College critical care nursing program were met with each Registered Nurse's demonstration of achievement of the objectives that had been established for the various components of the program.

Criterion for admission into the on-site CCNEP were determined by the Capital Health Region, but primarily consisted of a valid Registered Nurse license or temporary Graduate nursing license, and, a strong desire to pursue nursing opportunities within an adult critical care environment. Applicants were invited to apply for one of 50 funded positions available in the September 2002 program, and one of 45 funded positions available in February 2003. Each institution within the Capital Health Region received a set number of seats (applicants) that it was allowed to sponsor for the upcoming program. Once applications for the education program were received, the critical care nurse manager of the sponsoring institution interviewed the nurse applicants who had applied at that particular institution.

Interviews were conducted as opportunities not only to meet candidates, but also to review each individual's goals, previous student and/or work experience, and most importantly, assess the nurse's desire to work in an adult critical care unit. There were no pre-set entrance requirements for admission into the CCNEP, such as achievement of a specific grade-point average, experience in a critical care unit as part of a senior clinical practicum, or related experience in emergency, surgery, or medicine. Candidates selected by critical care nurse managers were those deemed best qualified

and most likely to succeed in the position for which they had been hired. Therefore, on the basis of one's application, interview results, and reference checks, nurses were admitted into the CCNEP.

Individuals responsible for the delivery of the CCNEP and education course content all function primarily as critical care educators for Mount Royal College. Both Mount Royal College critical care educators also maintain casual Registered Nurse status within Edmonton-based hospitals, and each work a variable number of bedside shifts during the year that the program was offered. There are no requirements that mandated nursing educators maintain a certain number of bedside critical care hours to teach in the Mount Royal College program. All educators are baccalaureate prepared; for this on-site program, one educator has a Master of Nursing degree while the other was enrolled in a Master of Nursing program. Both educators also have additional education courses in teaching and learning of adult learners.

The theoretical portion of the Level I critical care program (the first nine weeks) was highly structured and consisted of four main courses: physical assessment, physiology, pathophysiology, and pharmacology. For each of these four courses, a "binder" of learning material, illustrative of content presented in class and reflective of current critical care nursing practice, was given to each student. Moreover, on the first day of class, each student was also given a fifth binder of copyrighted material for the clinical portion of the program. Required textbooks included: *Mosby's Critical Care Assessment (Pocket Guide)*, *ECG's Made Easy,* the *2002 Handbook of Emergency Cardiovascular Care,* and the *Springhouse Nurses Drug Guide,* which

were provided by the College for each student.

During the first nine weeks of the theoretical portion of the program, classes were held Monday to Friday between 0900 and 1600 hours. During this time, content in each of the four theory courses was presented through formal lecture and group discussion, enhanced by audiovisual aids and demonstration of equipment by CCNEP educators. Theory in neurology, cardiovascular, respiratory, gastrointestinal (nutrition and metabolic), renal, and immune (inflammatory/immune/stress) systems from a critical care nursing perspective was addressed. Additionally, computer-assisted instruction via a website was made available as an additional learning resource for those students who desired further information on selected critical care topics of interest. Furthermore, each sponsoring institution could alternatively elect to provide unit-specific theoretical and practical instruction on selected conditions or procedures specific to the critical care unit into which the student had been hired, once nurses had completed the clinical component of the CCNEP.

During week 10 of the critical care education program, once formal theoretical instruction was concluded, five laboratory practice sessions were arranged for students. The five laboratory sessions, which consisted of physical assessment techniques, hemodynamic monitoring, oxygenation/ventilation, 12-lead ECG interpretation, and cardiopulmonary arrest, were each given one-day of intensive review (theoretical and practical "hands-on" experience with equipment) prior to the nurses' entering the critical care unit.

The clinical component of the CCNEP officially begins in week 11, once the theoretical component and laboratory review portions of the program had been

completed. Prior to the practicum, each student was asked to develop a set of personalized learning objectives for the critical care clinical experience. Once the practicum officially began, with the assistance of a more experienced nurse (the student's preceptor), the nurse began to apply cognitive knowledge to practice. Each student nurse was also asked to keep a clinical journal during the preceptorship, recording one's clinical experiences while on shift. One 30 to 60 minute case presentation was also required of each student during clinical experience, based upon a critical care patient and condition of interest for that nurse. Finally, each student wrote a 79-question multiple-choice examination during the final practical portion of the program that tested ability of the students' to apply basic critical care nursing concepts to selected patient care situations.

All students worked rotating 12-hour shifts with their preceptors during the final clinical experience. CCNEP educators visited clinical areas daily when students were scheduled for day and evening shifts. Although the majority of clinical time was spent working 12-hour shifts at the bedside, laboratory time during week 10 and the student's case presentation all counted towards clinical hours. Overall, while each student was expected to achieve 210 hours of clinical time, a mandatory minimum of 174 hours of clinical time in direct patient care (approximately 15 twelve-hour shifts) was required in an effort to demonstrate clinical independence.

Students progressed towards the achievement of theoretical and clinical objectives by obtaining the established passing marks on classroom tests and by successfully obtaining a passing grade in the clinical portion of the program. For the theoretical component of the CCNEP program, each student wrote 18 examinations (five

examinations in physiology, five in pathophysiology, five in health assessment, and three in pharmacology) in nine weeks. All examinations were a combination of multiple-choice and short answer. Students required an overall minimum-passing grade of 65% in each of the four courses. Students who did not achieve 65% on any one or more of the four required courses were not allowed to proceed with the clinical portion of the program. All of the examinations used in the program were subjected to reliability and validity testing.

Evaluation of the clinical component of the program was multifaceted. Students had to successfully pass the clinical examination (25%) that was written at anytime during the student's final practicum. The case presentation to fellow students and educators (25%), clinical journal (5%), and learning objectives (5%) were other assignments used to evaluate clinical progress of students. The clinical practicum itself, worth 40% of the final grade, was evaluated in two stages: a midterm and a final clinical evaluation.

Students were evaluated during the clinical practicum on knowledge, skill, attitude, and professional accountability in the clinical area. Responsibility for clinical evaluation of the CCNEP student nurse was a shared responsibility between the student, the student's preceptor, and the hospital-based critical care nurse educator. Written evaluation was completed using a clinical evaluation tool previously developed by Mount Royal College.

At the completion of the clinical portion of the program, students were assigned a grade. Students not achieving the required "satisfactory" grade (65%) did not graduate from the program. At the discretion of the nurse's employer, nursing

management, critical care educators, and/or preceptor, students may be given the option of being provided with additional clinical shifts in order to demonstrate competence. Given the amount of knowledge that students were expected to acquire and retain, coupled with the rigorous testing schedule adhered to by the college, issues or problems concerning students were often identified well before the nurses arrived at the clinical portion of the program.

Sample

The sample for this study was a convenience sample of Registered Nurses, 18 years of age or older, who had been admitted to the Mount Royal College Level I Advanced Studies in Critical Care Nursing Program, offered on-site in Edmonton, Alberta, in September 2002 (Group 1) and February 2003 (Group 2). This program was sponsored by the Capital Health Region, and co-sponsored by the Grey Nun's Hospital, Misericordia Hospital, Royal Alexandra Hospital, and University of Alberta Hospital.

Inclusion criteria for Registered Nurses to be admitted into the study were graduation from a recognized school of nursing program and current active registration (permanent license or temporary graduate permit) with the Alberta Association of Registered Nurses. In addition, none of the nurses were to have had any prior exposure to the *BKAT-6* examination.

Instruments

The *Basic Knowledge Assessment Tool-Version 6 (BKAT-6)* is a 100-item multiple-choice and fill-in-the-blank paper and pencil examination, developed by nurse researcher Jean Toth (1984). The *BKAT-6* was built upon previous versions of the *BKAT* (Toth, 1984; Toth, 1986; Toth, 1994; Toth & Dennis, 1993; Toth & Ritchey, 1984). The *BKAT-6* tests the ability of the critical care Registered Nursing students not only to recall basic critical care nursing knowledge, but also to apply that knowledge in specific critical care situations.

Each question on the *BKAT-6* is worth one point. One hundred questions, for a possible total score of 100 points, measured knowledge related to eight different areas of critical care nursing practice: (1) cardiovascular; (2) hemodynamic monitoring; (3) pulmonary; (4) neurology; (5) endocrine; (6) renal; (7) gastrointestinal; and (8) other (which included content on infection control, hypothermia, burns, and spiritual care). The *BKAT-6* can be completed in 45 minutes to one hour, and has been administered in both supervised and non-supervised settings.

Content of the initial *BKAT* examination was identified through several different mechanisms, including a review of current critical care nursing literature, interviews with critical care managers and staff nurses, suggestions from two critical care physicians, and nine experts of critical care nursing education and critical care nursing practice (Price, 1993; Toth, 1984). Validity of subsequent versions of the *BKAT* has been established through a panel of experts, and supported through learning theory, replication studies, and known group differences, including samples of baccalaureate, graduate, and practicing critical care nurses (Toth & Dennis, 1993).

Internal reliability for all versions of the *BKAT* examination has been determined by Cronbach's coefficient alpha (Toth, 1986; Toth, 1994). Reliability of the first two versions of the *BKAT* examination ranged from 0.83 to 0.86, and reliability of subsequent versions ranged from 0.83 to 0.91. Reliability of the *BKAT-6* was determined from a sample of critical care nurses ($n = 101$) from seven American states. Scores ranged from 62 to 99%, with a mean of 87.1% ($SD = 6.7$), and Cronbach's coefficient alpha of 0.80 (J. Toth, personal communication, February 4, 2002). This researcher had obtained permission from Dr. Toth to use the *BKAT-6* examination for this study.

The *Index of Work Satisfaction (IWS) Questionnaire,* originally developed by Slavitt, Stamps, Piedmont, and Haase (1978), is a two-part instrument specifically designed to measure overall group attitudes towards job satisfaction in nursing (Stamps, 1997). Six different components of job satisfaction have been incorporated into the instrument: 'Pay,' 'Autonomy,' 'Task Requirements,' 'Organizational Policies,' 'Professional Status,' and 'Interaction' (Bizek & Oermann, 1990; Fung-Kam, 1998; Stamps, 1997).

Part A of the *IWS Questionnaire* consists of 15-sets of paired comparisons, where each nurse is asked to choose which item (of the pair of the components) is most important. These rankings then identify the level of overall importance of each of the six components for the critical care nurses. In Part B, which consists of 44 'attitude' items on a Likert Scale (ranging from '1' [strongly agree] to '7' [strongly disagree]), identification of how strongly the nurse agrees or disagrees with a particular statement helps establish the nurse's current levels of satisfaction for each of the six

components (Stamps, 1997). The *IWS Questionnaire*, can be completed within 20 to 30 minutes, provides a maximum possible total score of 240 points on job satisfaction (Stamps, 1997), and of the six components of the scale, the higher the score the greater the job satisfaction. The actual "Index" is a single numerical value generated from both Part A and Part B of the *IWS Questionnaire* (Stamps, 2001), which represents each group's overall level of nursing job satisfaction.

Validity of the *IWS Questionnaire* was initially assessed by factor analysis (Bizek & Oermann, 1990; Oermann, 1995; Slavitt et al., 1978; Stamps, 1997). Internal reliability, using Cronbach's coefficient alpha, has been measured between 0.82 (Fung-Kam, 1998) to 0.912 (Bizek & Oermann, 1990) for the whole scale, and between 0.52 to 0.81 for the subscales (Fung-Kam, 1998). Stamps (1997) has reported that over seven administrations of the *IWS Questionnaire*, Cronbach's coefficient alpha for each of the components ranged from .696 to .900, producing an overall coefficient of 0.85. Moreover, given the two-part nature of the *IWS Questionnaire*, Kendall's tau was utilized to evaluate whether any significant differences between use of weighted score (total scale) and unweighted scores (Part B) existed. In seven studies, correlation was between 0.80 and 0.90 (Stamps, 1997).

The *Demographic Characteristics Data Sheet* (Appendix A) and *Situational Factors Data Sheet* (Appendix B) were developed by this researcher for the purpose of gathering information about the Registered Nurses who participated in the study. These data helped facilitate identification of demographic characteristics and situational factors of the critical care learning experience which may or may not have affected acquisition and retention of basic knowledge among Registered Nurses who

participated in the critical care education program.

Data Collection Procedure

Permission was obtained to access Registered Nursing students enrolled in the Mount Royal College Edmonton on-site CCNEP in September 2002 and February 2003. The researcher attended the first class of the September 2002 program and explained to the students both the nature and purpose of the study, and answered questions that the nurses had about their possible participation. Potential participants were informed that three 90-minute periods of time (or less) were required of each person to fulfill one's obligation in the study.

During the first class and following a voluntary decision to participate, each nurse was given a brown manila envelope containing the following: a letter of introduction indicating the nature and purpose of the study (see Appendix C); two consent forms (see Appendix D), one *Demographic Characteristics Data Sheet*, one *BKAT-6* examination, and one computerized scoring sheet. Participants were allotted 30 minutes to read the information letter, sign the consent form, and fill out the *Demographic Characteristics Data Sheet*. Sixty minutes was allotted to write the *BKAT-6* examination. At the end of 60 minutes, the contents (with the exception of the introductory letter and a second signed copy of the consent form for the student) were placed back in the envelope and returned to the researcher. The same procedure was followed for all subsequent examinations.

Due to circumstances beyond this researcher's control, a research assistant conducted the first examination for the February 2003 group. Otherwise, the researcher personally supervised the writing of the first and all other testing periods.

Each *BKAT-6* multiple-choice examination was initially hand-scored by the researcher before each examination was 'read' by computer optical scoring at the University of Alberta. A computerized answer key for the examination was developed by the researcher and double-checked by an independent source for correctness. Hand-scores of the *BKAT-6* examinations were then compared to the optical scores for accuracy.

At the end of the 15-week CCNEP (but no longer than 19 weeks) the nurses were contacted by the researcher by e-mail and telephone to confirm dates that had been arranged for the second phase of the critical care study. The nurses were asked to return to a designated room at one of the four teaching hospitals (the nurses choice of date and hospital) to write the *BKAT-6* examination a second time, and complete the *Situational Factors Data Sheet*. Unfortunately, only seven nurses attended over four test days at the various hospitals to complete the second part of the study. As a result, the researcher re-contacted each Registered Nurse in the study by e-mail and telephone to determine what day and time would allow for each nurse to complete the second phase of the study. Consequently, to secure the nurse's participation in the study, the researcher chose to meet each nurse individually at a public place and time of that nurse's choosing. Lastly, at a point in time no less than six months (but no greater than seven months) after writing the second examination, participants were again contacted by the researcher by e-mail and telephone to confirm a place and time for that nurse to write the third *BKAT-6* examination and complete the *IWS Questionnaire*. A total of 42 critical care Registered Nurses who had successfully completed the CCNEP completed all three phases of the critical care study.

Data Analysis

Data analysis was undertaken using the Statistical Package for the Social Sciences (SPSS), Version 11.0.1 for Windows (SPSS Inc, Chicago, Illinois, 1998). Descriptive statistics (mean, median, mode, standard deviation, variance, range, and percentages), in the form of tables, charts, and graphs, were created to display and analyze demographic characteristics, *BKAT-6* examination scores, CCNEP theory (course) grades, CCNEP clinical (practicum) grades, situational factors of the experience, and the six components of the *IWS Questionnaire*.

Not every nurse provided a response for each of the questions on the various instruments used in this study. In one situation, a nurse completed the first *BKAT-6* examination, but chose not to provide any information on the demographic questionnaire; in another situation, a nurse also completed the first *BKAT-6* examination but did not provide any information for future contact. Therefore, variable sample sizes for statistical analysis were observed.

Data from the Mount Royal College CCNEP and the *IWS Questionnaire* required special attention prior to being statistically analyzed for the purposes of this study. At the completion of the CCNEP, a letter grade was obtained by each Registered Nurse for each theory course and for the clinical component of the program. For the purposes of this study, it was necessary to convert the letter grades into numerical values. Instructors of the CCNEP provided a template that identified the range of possible marks for each of the letter grades. For example, the extent of marks possible for a B+ corresponded to a range between 80 to 85.99%. Therefore, if a nurse achieved a B+, the mean score of the range (for example, 82.995) was

assigned to that letter grade.

As a result, one mean score was assigned for each of the four separate theory courses (physiology, pathophysiology, pharmacology, and health assessment), and one mean score for the clinical component of the program. To calculate a composite theory grade for each nurse, the four mean scores from the theory courses were added and divided by four (the number of courses) to obtain a single numerical value. This single numerical value represented the individual score of each Registered Nurse for the theory component of the CCNEP. Similarly, the mean score that corresponded to the assigned letter that had been awarded to each nurse for the clinical component of the program was the value used as the numerical clinical grade.

Data analysis of the *IWS Questionnaire* was undertaken and completed as described by the author of the instrument (Stamps, 2001). As well, as suggested by Stamps (2001) for further statistical analysis, the 'Interaction' component of the *IWS Questionnaire* was further divided into two subscales: 'Interaction Between Nurses,' and 'Interaction Between Nurses and Physicians.' In the end, as a result of hand-scoring the *IWS Questionnaire*, a 'group' score was obtained for both Group 1 (September 2002) and Group 2 (February 2003). In addition, data from both Group 1 and Group 2 was combined and hand-scored a third time, to produce an overall picture of job satisfaction for both groups of critical care nurses as a single cohort. However, to help interpret data from the *IWS Questionnaire* and facilitate identification of a possible relationship between knowledge retention (*BKAT-6* [P3] test scores) and job satisfaction, an individual job satisfaction score was required of each nurse.

To create an individual job satisfaction score for each Registered Nurse, responses from each nurse for all 44 'attitude' items in Part B (which assessed each Registered Nurse's *current* level of satisfaction with each of the six components) was entered for analysis. To help avoid a response bias from nurses completing the survey, some of the 'attitude' items were 'positively' worded and some statements were 'negatively' worded. Therefore, all survey items that had been identified in the *IWS Questionnaire* scoring manual as 'negatively' worded were recoded after being entered into the SPSS program. In other words, if a nurse strongly agreed with a negatively worded survey item, recoding of data ensured that the nurse obtained a lower numerical score to indicate greater dissatisfaction with that item.

Each of the 44 items on Part B of the *IWS Questionnaire* corresponded to one of the six components of the scale. Accordingly, all survey statements that related to each particular component were added, and then divided by the number of survey items that assessed that particular component of job satisfaction. For example, all survey statements that related to the component 'Pay' (question numbers 1, 8, 14, 21, 32, and 44) were summed and then divided by the number of survey items in that category (for example, six), creating an average score for that component. As a result, this created an individual job satisfaction score for each Registered Nurse on each of the six components of the *IWS Questionnaire*.

To ensure accuracy of data entry and correctness of the SPSS calculations that had just been completed, descriptive statistics on each of the six components of the *IWS Questionnaire* was compared to the hand calculations (Component Mean Scores) completed for the overall Combined Group, Group 1, and Group 2. The creation of an

individual job satisfaction score for each Registered Nurse, as well as group satisfaction scores for each of the six components (for comparison against other mean groups of scores), was validated by the author of the *IWS Questionnaire* (P.L. Stamps, personal communication, March 24, 2004).

To determine if the September 2002 (Group 1) and February 2003 (Group 2) critical care nursing students were similar on demographic characteristics and other variables being examined in this study (CCNEP theory and clinical grades, situational factors of the experience, and job satisfaction), an independent samples t-test was employed. Given the lack of statistically significant differences between the two groups, data from both groups were collapsed and examined as a single cohort (the Combined Group). In addition, a repeated measures analysis of variance (ANOVA) was used to examine whether changes in *BKAT-6* knowledge scores had occurred over time and between groups. Finally, to explore the relationships among study variables, Chi square or Pearson's *r* was used to examine *BKAT-6* knowledge scores of the nurses and demographic characteristics of the nurses, CCNEP theory grades, CCNEP clinical grades, situational factors of the experience, and the six components of the *IWS Questionnaire*. The level of statistical significance was $p < 0.05$.

Ethical Considerations

Ethical approval for this research study was obtained from both the Mount Royal College Ethics Review Board in Calgary, Alberta, and the Capital Health Region Health Research Ethics Board in Edmonton, Alberta. The researcher obtained permission from the Faculty of Health and Community Studies, Mount Royal College, to access the CCNEP students. In addition, the researcher met with Mount

Royal College program instructors to explain the study and the amount of class time that was required for the study to occur.

The researcher accessed participants through the first class of the CCNEP. At this time, the researcher fully explained to the students the purpose of the study and the intended contribution of the study to critical care nursing education (see Appendix C). Each participant agreed to be in the study voluntarily, and a signed consent form indicating his or her willingness to participate was required (see Appendix D).

Participants were informed that all data collected as a result of this study would be coded with a numeric study number, with each subject assured of complete confidentiality, and that no names would appear in the final report. Only the researcher knew the identity and associated numeric study number of each participant. A master copy of study participants and associated code numbers is currently being kept in a locked drawer and all data will be destroyed after five years.

Subjects were informed that there might not be any direct benefits to them as a result of participating in this study. The nurses were similarly told that test results would not be used for any kind of performance evaluation, disciplinary measure, basis for subsequent employment in critical care, nor would examination scores be shared with Mount Royal College, Capital Health Region, critical care nursing program educators, or critical care managers in any manner whatsoever. Any questions posed to the researcher by the participants at the beginning, middle, or end of the study were answered as completely as possible. Participants were also informed of their right to withdraw from the study at anytime, by verbally indicating to the researcher that they no longer wished to be part of the study, or by returning

unanswered examinations and questionnaires to the researcher.

At the completion of the study, and only at the request of the nurse, a copy of that individual's examination scores was made available to the participant. At that time, the researcher made available the opportunity to review the examination with the participant. If a nurse scored poorly on any or all *BKAT-6* examinations, the researcher facilitated (at the nurse's request) identification of additional learning resources or sources of information. Furthermore, all participants were informed that the researcher intended to publish the completed study, but neither individual nurses, the specific CCNEP, nor location of this study would be identified in the final report.

CHAPTER FOUR

Findings

A descriptive correlational design with repeated measures was used to explore the relationship of knowledge acquisition, knowledge retention, and job satisfaction of Registered Nurses who had completed an adult critical care nursing education program (CCNEP). For each Registered Nurse, the 15-week CCNEP consisted of nine weeks of theoretical instruction, which covered content in physical assessment, physiology, pathophysiology, and pharmacology. This was followed by one week of laboratory practice, where students had an opportunity to review and practice clinical skills and procedures before entering the critical care unit. Each nurse then completed five weeks of preceptored clinical experience, approximately 210 hours, in the critical care unit into which the nurse had been hired.

Nurses completed the *Demographics Characteristics Data Sheet* (see Appendix A) and the *BKAT-6* examination on the first day (Phase 1, P1) of the CCNEP. At the conclusion of the CCNEP (Phase 2, P2), nurses re-wrote the *BKAT-6* examination and completed the *Situational Factors Data Sheet* (see Appendix B). Six months after the CCNEP had officially ended (Phase 3, P3), nurses re-wrote the *BKAT-6* examination and completed the *Index of Work Satisfaction (IWS) Questionnaire.* Data were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 11.0.1. A repeated measures ANOVA was used to examine changes in knowledge scores over time and between groups. Relationships among knowledge scores, demographic characteristics, situational factors of the critical care learning experience, and job satisfaction were assessed using Chi-Square or Pearson's *r*.

Demographic Characteristics of the Nurses

The sample included two groups of Registered Nurses, one from the September 2002 (Group 1 [n = 50]) and one from the February 2003 (Group 2 [n = 18]) CCNEP. These Registered Nurses had been hired to work in critical care units at one of four hospitals in the Capital Health Region. The nurses practiced in a number of different critical care specialty areas, but each nurse had been hired for only one critical care unit. The two groups of critical care Registered Nurses were analyzed separately, and then compared for statistically significant differences between the two groups. There were no significant differences between the two groups, so both groups were combined and subsequently analyzed as a single cohort (Combined Group).

The mean age of the Combined Group was 27.53 years (SD = 5.82), with 49 nurses (74.2%) being 30 years of age or less at the time of the study. The Registered Nurses were predominantly female (n = 57, 85.1%), while 10 males (14.9%) chose to take part. Most nurses identified their highest level of nursing education as baccalaureate (n = 50, 73.5%), while 16 nurses (23.5%) indicated that they were diploma-prepared.

Most nurses (n = 42, 63.6%) reported having graduated from nursing school the year this study was undertaken, while only seven nurses (10.5%) reported graduating >10 years ago. The mean length of time employed as a Registered Nurse of the Combined Group was 29.74 months (SD = 55.72), although most nurses identified having been employed as a Registered Nurse one year or less (n = 42; 64.6%). Fourteen nurses (21.4%) acknowledged employment as a Registered Nurse for one to five years. Of the nurses who chose to take part in this study, 47 (69.1%) of the nurses

indicated that critical care was not their first area of employment (see Table 1).

Table 1

Demographic Characteristics: Gender, Education, First Employment

	Combined		Group 1		Group 2		
	n	%	*n*	%	*n*	%	*p*
Gender							.439
Female	57	83.8	43	86.0	14	77.8	
Male	10	14.7	6	12.0	4	22.2	
Highest Level of RN Education Obtained							.633
RN	16	23.5	11	22.0	5	27.8	
BScN	50	73.5	38	76.0	12	66.7	
Critical Care First Area of Employment							.297
Yes	20	29.4	17	34.0	3	16.7	
No	47	69.1	32	64.0	15	83.3	

Nursing Employment Before Critical Care

The Registered Nurses reported a diversity of previous nursing experience prior to enrolling in the CCNEP. Medicine ($n = 14$, 20.6%) and surgery ($n = 11$, 16.2%) were the most frequently reported areas of employment pre-critical care. "Other" ($n = 10$, 14.7%) nursing experience identified by Registered Nurses included care of burn patients, specialized cardiac and nephrology step-down units, intravenous therapy, palliative care nursing, rural hospital nursing experience, and spinal cord

rehabilitation (see Table 2).

Table 2

Demographic Characteristics: Area of Employment Pre-Critical Care

	Combined		Group 1		Group 2		
	n	%	*n*	%	*n*	%	*p*
Area of Employment Pre-Critical Care							.165
Emergency	3	4.4	1	2.0	2	11.1	
Geriatrics	1	1.5	0	0.0	1	5.6	
Oncology	2	2.9	2	4.0	0	0.0	
Medicine	14	20.6	7	14.0	7	38.9	
Operating Room	1	1.5	1	2.0	0	0.0	
Pediatrics	1	1.5	1	2.0	0	0.0	
Surgery	11	16.2	9	18.0	2	11.1	
Float	2	2.9	2	4.0	0	0.0	
Other*	10	14.7	8	16.0	2	11.1	

*Other: Burn unit, cardiac step-down unit, nephrology step-down unit, intravenous therapy, palliative care, rural hospital experience, and spinal cord rehabilitation

The mean length of pre-critical care nursing employment of the Combined Group was 22.44 months (SD = 28.41), with a range of two to 120 months (M = 22.44, SD = 28.41). Although not statistically significant, Group 1 nurses reported a greater mean length of pre-critical care nursing employment at 28.10 months (SD = 32.74), while Group 2 nurses had a shorter mean length of employment prior to critical care at 10.71 months (SD = 8.85).

Current Critical Care Nursing Employment

Most Registered Nurses reported having been hired for general systems (n = 35, 57.4%), or cardiac (n = 10, 16.4%) critical care units. "Other" (n = 10, 16.4%) critical care nursing areas Registered Nurses reported being employed included a critical care burn unit, emergency, a combined general systems/cardiac care unit, and a critical care float pool. Seven nurses (10.3%) did not indicate the critical care unit into which they had been hired.

The Combined Group mean length of current critical care employment was 4.23 months (SD = 2.01), with a range of two to 10 months. Although not statistically significant, nurses in Group 2 reported a greater mean length of current critical care employment, with a mean of 7.50 months (SD = 3.54), compared to nurses in Group 1, who reported a mean length of 3.64 months (SD = 1.03). Nearly all nurses reported that their employment status in critical care was full time (n = 59, 95.2%), while one nurse (2.2%) was uncertain about employment status. Registered Nurses identified that they most often worked 12-hour shifts (n = 61; 89.7%), and that their current critical care shift pattern consisted of rotating day, evening, and night shift (n = 61; 98.4%). One nurse reported working day and evening shift only (1.6%) (see Table 3).

Previous Exposure to Critical Care

Of the 68 Registered Nurses who initially participated in P1 of this study, 30 (44.1%) nurses reported some type of previous exposure to the critical care environment. Nurses in Group 1 (n = 21, 42.0%) reported more previous exposure to the critical care area than nurses in Group 2 (n = 9, 50.0%), but this difference was

Table 3

Demographic Characteristics: Current Critical Care Employment

	Combined		Group 1		Group 2		
	n	%	*n*	%	*n*	%	*p*
Current Critical Care Unit							.374
Cardiac	10	16.4	6	23.5	4	13.6	
General Systems	35	57.4	26	52.9	9	59.1	
Medicine	1	1.6	0	5.9	1	0.0	
Neurology	2	3.3	1	5.9	1	2.3	
Thoracic/ Vascular	3	4.9	3	0.0	0	6.8	
Other	10	16.4	8	11.8	2	18.2	
Employment Status							.333
Full Time	59	95.2	43	94.1	16	95.6	
Part Time	1	1.6	0	5.9	1	0.0	
Casual	1	1.6	1	0.0	0	2.2	
Other+	1	1.6	1	0.0	0	2.2	
Hours Worked Per Day							.641
12 Hour Shifts	61	89.7	44	94.4	17	88.0	
Other^	2	2.9	2	0.0	0	4.0	
Current Shift Pattern							.274
Rotating	61	98.4	45	94.1	16	100.0	
Other~	1	1.6	0	5.9	1	0.0	

*Other: Critical care burn unit, emergency, combined general systems/cardiac care unit, and critical care float pool
+Other: Uncertain
^Other: 8-hour shifts, combination 8 and 12-hour shifts
~Other: Permanent days/evenings

not significant. In the Combined Group, 33 nurses (48.5%) reported no previous experience or exposure to critical care (see Table 4). For the 30 nurses who identified previous exposure to critical care, this had primarily occurred as part of a student nurse experience (n = 23; 74.2%).

Table 4

Demographic Characteristics: Previous Exposure to Critical Care

	Combined		Group 1		Group 2		
	n	%	*n*	%	*n*	%	*p*
Previous Exposure to Critical Care							.568
Yes	30	44.1	21	42.0	9	50.0	
No	33	48.5	26	52.0	7	38.9	

Student Nurse Experiences in Critical Care

The Combined Group of nurses identified that previous experiences in critical care as students had most often occurred in a general systems unit (n = 17, 65.4%), while cardiac, thoracic/vascular, and surgical critical care area had served as units for other student nurse clinical placements (see Table 5).

The Combined Group mean length of how long ago student nurse critical care experiences had occurred was 31.30 months (SD = 67.56), with a range of three to 312 months, while 17 nurses (73.7%) reported the student critical care opportunities had occurred within the previous 12 months prior to the CCNEP. Although not significant, nurses in Group 2 acknowledged that student nurse critical care

Table 5

Demographic Characteristics: Student Nurse Critical Care Experiences

	Combined		Group 1		Group 2		
	n	%	*n*	%	*n*	%	*p*
Previous Exposure to Critical Care Student	23	74.2	18	81.8	5	55.6	.229
Student Nurse Experience: Type of Unit							.940
Cardiac	3	11.5	2	10.0	1	16.7	
General Systems	17	65.4	13	65.0	4	66.7	
Surgery	1	3.8	1	5.0	0	0.0	
Thoracic-Vascular	1	3.8	1	5.0	0	0.0	
Other*	4	15.4	3	15.0	1	16.7	

*Other: Critical care burn unit, neonatal intensive care, combined general systems/cardiac care unit

experiences had occurred most recently (M = 16.17, SD = 15.73), while nurses in Group 1 reported mean length of time since student critical care placement was 36.65 months (SD = 77.98). Nurses in Group 1 reported a mean length of student critical care experiences of 2.31 months (SD = 1.07). Similarly, nurses in Group 2 reported average mean length of critical care experiences as a student at 2.33 months (SD = 1.03). All nurses in the Combined Group identified that average mean length of student nurse critical care experience was between one to four months (M = 2.31, SD = 1.04).

Other Experiences in Critical Care

In addition to previous critical care exposure as a student nurse, other experiences in critical care reported by the Combined Group ($n = 9$) prior to the CCNEP included earlier nursing-related and non-nursing employment. Of these nine nurses, four nurses (44.4%) identified previous employment in general systems critical care, and five nurses (55.5%) identified a burn unit, combined general systems/cardiac care unit, and surgical critical care units as areas of previous employment. Nurses in Group 2 ($n = 5$) reported more nursing-related and non-nursing critical care employment than the nurses in Group 1, but this difference was not significant.

Employment as part of a region-specific Graduate Nurse Initiative (GNI) Program, or having been hired as an Employed Nursing Student (ENS), were nursing-related avenues of employment identified by the Combined Group. For both GNI and ENS employment, nurses would not have been independent in clinical practice. Non-nursing job titles identified by the nurses in the Combined Group pre-CCNEP included having been hired as a unit clerk, service aide, or a combined unit clerk/service aide.

The mean length of how long ago nursing-related and non-Registered Nurse employment occurred for the Combined Group was 19.88 months ($SD = 9.98$). Employment occurred as little as three months ago and as long as three years pre-CCNEP. Nurses in Group 1 reported employment most recently with a mean of 15.75 months ($SD = 10.2$); nurses in Group 2 reported nursing-related and non-nursing employment had occurred a mean 29 months earlier ($SD = 9.02$).

The Combined Group mean length of previous employment in critical care (but

not as a Registered Nurse) was 12.56 months (*SD* = 8.40), with a range of two to 24 months. Nurses in Group 2 reported a mean length of employment of 14.40 months (*SD* = 7.30), while nurses in Group 1 reported a mean of 10.25 (*SD* = 10.20). Six nurses (66.7%) identified they had worked in critical care one year or less, while only two nurses (33.3%) reported mean lengths of employment of 20 and 24 months, respectively.

In the Combined Group, only three nurses acknowledged previous employment as a Registered Nurse in critical care. Two of these nurses were from Group 1; the other nurse was from Group 2. One nurse reported previous employment in a general systems unit, one nurse in a surgical critical care unit, and the third nurse was previously employed as a critical care float.

The Combined Group mean length of time since employment as a Registered Nurse in critical care had occurred was 22.08 months (*SD* = 19.14). One nurse (33.3%) reported having just completed employment in critical care prior to entering the CCNEP, while two nurses (66.6%) reported employment had occurred two and a half to three years ago. The Combined Group mean length of previous employment as a critical care Registered Nurse was 32 months (*SD* = 24.25). Of these three nurses, two nurses had been previously employed for 18 months; the other nurse had been employed previously for 60 months.

Previous Critical Care Nursing Programs/Courses

When participants in this study were asked whether or not they had previously taken any type of critical care nursing education course or program, 60 Registered Nurses (88.2%) identified never having previously enrolled in or completed such a

program. While none of the nurses in Group 1 had taken any previous critical care nursing course or program, two nurses (11.1%) in Group 2 reported previous critical care learning opportunities ($p = 0.019$)(see Table 6).

Table 6

Demographic Characteristics: Previous Critical Care Programs/Courses

	Combined		Group 1		Group 2		
	n	%	*n*	%	*n*	%	*p*
Previous Critical Care Program							**.019**
Yes	2	2.9	0	0.0	2	11.1	
No	60	88.2	47	94.0	13	72.2	

One nurse reported having taken a hospital-based critical care nursing program, while the second nurse reported a university-based program. One nurse had participated in a program four months ago; the other nurse participated in a program three years ago. Both nurses reported previous critical care education courses/programs to be one month in length.

BKAT-6 Examination Scores

The Combined Group mean *BKAT-6* examination score at P1 was 61.81% (*SD* = 9.01), with a range of 41 to 79%. At the conclusion of the CCNEP 15-weeks later, *BKAT-6* (P2) knowledge scores had increased to 76.10% (*SD* = 6.60), with a

range of 63 to 89%. Six months after the Registered Nurses had successfully completed the CCNEP, the Combined Group mean *BKAT-6* (P3) score was 76.79% (*SD* = 6.62), with a range of 59 to 88%.

An examination of each group separately revealed that in Group 1, the mean *BKAT-6* (P1) score was 63.33% (*SD* = 8.20), with a range of 45 to 79%. At P2, Group 1 *BKAT-6* mean score had increased to 76.87% (*SD* = 6.61), with a range of 63 to 89%, and at P3, the mean *BKAT-6* score was 77.53% (*SD* = 6.80), with a range of 59 to 88%. In Group 2, a mean *BKAT-6* (P1) score was 58.00% (*SD* = 10.15), with a range of 41 to 75%. This was followed with a mean *BKAT-6* (P2) score for Group 2 of 74.17% (*SD* = 6.45), with a range of 63 to 84%. And at P3, the mean *BKAT-6* score was 74.92% (*SD* = 6.04), with a range of 62 to 82% (see Table 7). To assess whether or not there was a difference in *BKAT-6* scores between groups, a repeated measures analysis of variance (ANOVA) was conducted. There were no statistically significant differences found between the two groups of nurses [F (1,40) = 2.597, p = .115].

Knowledge scores of the Combined Group of Registered Nurses significantly increased from a mean of 61.81 (*SD* = 9.01) on the *BKAT-6* at P1, to a *BKAT-6* (P2) mean of 76.10 (*SD* = 6.60) and six months later, to at *BKAT-6* (P3) mean of 76.79 (*SD* = 6.62)[F (1.83, 73.34) = 135.88, $p < .001$, with Huyn Feldt correction]. *BKAT-6* scores increased 14.31% from P1 to P2, and 14.88% points from P1 to P3. There was no reported difference, however, between *BKAT-6* scores from P2 to P3 (see Table 8).

Table 7

BKAT-6 Examination Scores

		n	Mean	Standard Deviation
Phase 1 (P1):	*BKAT-6*			
Pre-Critical Care Nursing Program	Group 1	30	63.33	8.20
	Group 2	12	58.00	10.15
	Combined	42	61.81	9.01
Phase 2 (P2):	*BKAT-6*			
Post-Critical Care Nursing Program	Group 1	30	76.87	6.61
	Group 2	12	74.17	6.45
	Combined	42	76.10	6.60
Phase 3 (P3):	*BKAT-6*			
6 Months Post-Critical Care Nursing Program	Group 1	30	77.53	6.80
	Group 2	12	74.92	6.04
	Combined	42	76.79	6.62

Table 8

Analysis of Variance (ANOVA) Multiple Comparisons: BKAT-6 Examination Scores

	BKAT-6 Exam	*BKAT-6* Exam	Mean Difference	Standard Error	*p*
Scheffe	P1	P2	14.31	1.398	**.000**
		P3	14.88	1.479	**.000**
	P2	P1	14.31	1.398	**.000**
		P3	.57	1.552	.935

P1: Phase 1 (Pre-Critical Care Nursing Program); P2: Phase 2 (Post-Critical Care Nursing Program); P3: Phase 3 (Six Months Post-Critical Care Nursing Program)

Four nursing students did not complete the Mount Royal College CCNEP. Of the four nurses who did not complete the program, three nurses participated in P2 of this study. A requirement to continue participation in the study was the successful completion of the entire CCNEP program. Therefore, given that these nurses had not successfully completed the entire program, P2 study results for this group of nurses were analyzed separately.

The mean *BKAT-6* (P2) examination score for the Combined Group of nurses who had not completed the CCNEP was 58.00% (*SD* = 6.08), with a range of 51 to 62%. This score was lower than the Combined Group mean score at P2, and lower than each of the two separate groups' mean *BKAT-6* scores at P2. Of interest, the mean *BKAT-6* examination score for the nurses who had not completed the CCNEP at P1 was 52.67 (*SD* = 9.87), with a range of 46 to 64%. Like the *BKAT-6* (P2) examination results, the *BKAT-6* (P1) scores for the unsuccessful group were lower than the Combined Group mean of 61.35 (*SD* = 8.85) on the first day of the CCNEP, and, lower than both Group 1 and Group 2 at P1. Although *BKAT-6* (P2) scores had increased post-program for nurses who had not successfully completed the CCNEP, mean *BKAT-6* (P2) scores were higher for those nurses who had successfully completed the program. Of the three nurses who had not completed the CCNEP but participated in P2, none of these nurses participated in the final phase of the study six months later.

Critical Care Nursing Program Grades

The Combined Group mean theory grade of the nurses, as a result of their participation in the CCNEP, was 86.41% (*SD* = 5.65), with marks ranging between

74 to 95%. Group 1 theory grades, which had a mean score of 86.13% (*SD* = 5.78), and a range of 76 to 95%, were slightly less than that of Group 2, who had slightly higher theory grades with a mean score of 87.11% (*SD* = 5.39), and a range of marks between 74 to 95%.

For the clinical component of the CCNEP, the Combined Group mean score was 90.06% (*SD* = 6.62), with a range of 67 to 95%. Like the theory grades, clinical grades for Group 1 (*M* = 89.87, *SD* = 6.31), with a range from 70 to 95%, were slightly less than the clinical grades achieved by Group 2 (*M* = 90.56, *SD* = 7.52), with a range between 67 to 95%. No known group differences existed between Group 1 and Group 2 for either theory or the clinical practicum grades achieved in the CCNEP (see Table 9).

Table 9

Critical Care Nursing Education Program (CCNEP):

Theory (Course) Grades and Clinical (Practicum) Grades

	Combined			Group 1			Group 2			
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*p*
Theory Grades	63	86.41	5.65	45	86.13	5.78	18	87.11	5.39	.539
Clinical Grades	63	90.06	6.62	45	89.87	6.31	18	90.56	7.52	.712

Situational Factors of the Critical Care Learning Experience

The Registered Nurses completed the *Situational Factors Data Sheet* during P2 of this study. Using a five-point Likert scale, each nurse was asked to identify how strongly he or she had perceived four important aspects of the CCNEP experience ('Preceptorship,' 'Opportunity for Practice,' 'Feedback' and 'Overall Satisfaction' with the program) had helped facilitate their learning.

As a Combined Group, the Registered Nurses identified 'Opportunity for Practice,' with a mean of 4.45 (SD = .832) as the most important situational factor that had helped their learning during the CCNEP. 'Overall Satisfaction' with the CCNEP, with a mean of 4.37 (SD = .747) was also an important factor for the nurses, as was 'Preceptorship,' with a mean of 4.39 (SD = .723). Results indicated that the Combined Group of nurses had perceived 'Feedback' (M = 4.02, SD = .948) as the least helpful situational factor of the critical care learning experience. The range of marks for each of the four situational factors of the Combined Group varied from one to five.

Examined as separate groups, the nurses in Group 1 identified that 'Opportunity for Practice' (M = 4.63, SD = .547), with a range of three to five, was most important, while Group 2 nurses acknowledged 'Overall Satisfaction' with the CCNEP (M = 4.13, $S D$= .957), with a range of one to five, as the most important factor that had helped students learn. Group 1 nurses rated 'Preceptorship' (M = 4.57, SD = .502), with a range of four to five, and 'Overall Satisfaction' (M = 4.49, SD = .612), with a range of three to five, as the second and third most important elements of the CCNEP experience, while Group 2 perceived 'Opportunity for

Practice' ($M = 4.06$, $SD = 1.18$), with a range of one to five, and 'Preceptorship' ($M = 4.00$, $SD = .966$), with a range of one to five, as their second and third most important factors. For both Group 1 and Group 2, the lowest scoring element of all the situational factors was 'Feedback,' with a mean score of 4.20 ($SD = .719$), with a range of two to five for Group 1, and a mean score of 3.63 ($SD = 1.26$), with a range of one to five for Group 2. No known group differences existed between Group 1 and Group 2 on any of the four situational factors (see Table 10).

Table 10

Situational Factors of the Critical Care Learning Experience

	Combined			Group 1			Group 2			
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*p*
Preceptorship	51	4.39	.723	35	4.57	.502	16	4.00	.966	.054
Opportunity for Practice	51	4.45	.832	35	4.63	.547	16	4.06	1.18	.221
Feedback	51	4.02	.719	35	4.20	.719	16	3.63	1.26	.084
Overall Satisfaction	51	4.37	.747	35	4.49	.612	16	4.13	.957	.137

Nurses who had not completed the CCNEP but completed P2 of this study acknowledged 'Opportunity for Practice' ($M = 4.67$, $SD = .577$), with a range of four to five, as the most important situational factor. All other factors ('Preceptorship,' 'Feedback,' and 'Overall Satisfaction') scored equally ($M = 4.00$) among all three nurses.

Job Satisfaction of the Critical Care Nurses

The *Index of Work Satisfaction (IWS) Questionnaire* was a two-part scale that the Registered Nurses completed at P3, six months after having entered critical care nursing practice. Part A of the *IWS Questionnaire* consisted of a set of 15 "forced-choice" comparison questions where nurses were asked to choose which of two components of the *IWS Questionnaire* were most important to them. This established the overall level of importance of the six components ('Pay,' 'Autonomy,' 'Task Requirements,' 'Organizational Policies,' 'Professional Status,' and 'Interaction') for the Registered Nurses. In Part B of the *IWS Questionnaire*, a series of 44 'attitude' statements assessed the critical care Registered Nurses' current level of satisfaction with each of the six components of the scale.

Overall Importance of Components in Nursing Job Satisfaction

From part A of the *IWS Questionnaire*, the Combined Group of nurses in this study identified 'Autonomy,' ($M = 3.82$), 'Interaction' ($M = 3.54$) and 'Professional Status' ($M = 3.12$) as the three most important components to overall job satisfaction. 'Pay' ($M = 3.02$) ranked fourth, and 'Task Requirements' ($M = 2.45$) was fifth most important overall. 'Organizational Policies' ($M = 2.14$) was the least important component of job satisfaction for the Combined Group of critical care nurses.

As separate groups, Group 1 ranked 'Autonomy' ($M = 3.78$) as the most important component of job satisfaction, followed by 'Interaction' ($M = 3.51$) and 'Professional Status ($M = 3.31$). Similarly, Group 2 also identified 'Autonomy' ($M = 4.02$) as the singular most important component, then 'Interaction,' ($M = 3.74$) followed by 'Task Requirements' ($M = 3.16$). 'Pay' was ranked fourth in terms of overall importance by both Group 1 ($M = 3.02$), and Group 2 ($M = 3.00$). Group 1 acknowledged 'Task Requirements' ($M = 2.85$) as the fifth most important component, while Group 2 identified 'Professional Status' ($M = 2.63$) as fifth overall. Both Group 1 ($M = 2.12$) and Group 2 ($M = 2.13$) agreed, however, that 'Organizational Policies' was the least important component in current job satisfaction (see Table 11).

Table 11

Index of Work Satisfaction (IWS): Part A - Overall Level of Importance of Components

	Combined ($n = 42$)	Group 1 ($n = 30$)	Group 2 ($n = 12$)
	M	*M*	*M*
Pay	3.02	3.02	3.00
Autonomy	3.82	3.78	4.02
Task Requirements	2.95	2.85	3.16
Organizational Policies	2.14	2.12	2.13
Professional Status	3.12	3.31	2.63
Interaction	3.54	3.51	3.74

Current Level of Importance of Components in Nursing Job Satisfaction

From Part B of the *IWS Questionnaire*, analysis revealed the Combined Group of nurses was currently most satisfied with 'Professional Status' ($M = 5.39$, $SD = .682$), with a range of 4.29 to 6.71. 'Interaction' ($M = 4.97$, $SD = .960$), with a range of 2.10 to 6.20, 'Autonomy' ($M = 4.73$, $SD = .727$), with a range of 2.50 to 6.00, and 'Pay' ($M = 4.53$, $SD = .914$), with a range of 2.50 to 6.17, were the second, third, and fourth most important components of the nurses' current level of nursing job satisfaction. The Combined Group also identified that elements perceived as having the least impact on current level of job satisfaction were 'Task Requirements' ($M = 4.17$, $SD = 1.09$), with a range of 1.67 to 6.00, and 'Organizational Policies' ($M = 3.10$, $SD = .750$), with a range of 1.14 to 4.57.

Analyzed separately, Group 1 Registered Nurses reported current level of critical care nursing job satisfaction most influenced by 'Interaction' ($M = 5.26$, $SD = .741$), with a range of 3.50 to 6.20, 'Professional Status' ($M = 5.38$, $SD = .728$), with a range of 4.29 to 6.71, and 'Autonomy' ($M = 4.87$, $SD = .622$), with a range of 3.63 to 6.00. 'Pay' ($M = 4.40$, $SD = .928$), with a range of 2.50 to 6.17, ranked fourth, while 'Task Requirements' ($M = 4.19$, $SD = 1.17$), with a range of 1.67 to 6.00 and 'Organizational Policies' ($M = 3.26$, $SD = .660$), with a range of 1.57 to 4.57 were the least important components.

In Group 2, nurses identified being most satisfied with 'Professional Status' ($M = 5.40$, $SD = .580$), with a range of 4.57 to 6.29, 'Pay' ($M = 4.85$, $SD = .833$), with a range of 2.83 to 5.67, and 'Autonomy' ($M = 4.37$, $SD = .870$), with a range of 2.50 to 5.63. 'Interaction' ($M = 4.24$, $SD = 1.08$), with a range of 2.10 to 5.90, appeared

not as important to the nurses in Group 2 compared to those in Group 1. Like Group 1, however, Group 2 nurses agreed that 'Task Requirements' ($M = 4.10$, $SD = .914$), with a range of 2.67 to 5.67, and 'Organizational Policies' ($M = 2.73$, $SD = .856$), with a range of 1.14 to 4.57, were least important in determining current levels of job satisfaction (see Table 12).

Table 12

Index of Work Satisfaction (IWS): Part B - Current Level of Satisfaction

	Combined			Group 1			Group 2			
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*p*
Pay	42	4.53	.914	30	4.40	.928	12	4.85	.833	.619
Autonomy	42	4.73	.727	30	4.87	.622	12	4.37	.870	.321
Task Requirements	41	4.17	1.09	29	4.19	1.17	12	4.10	.914	.850
Organizational Policies	42	3.10	.750	30	3.26	.660	12	2.73	.856	.073
Professional Status	42	5.39	.682	30	5.38	.728	12	5.40	.580	.941
Interaction	42	4.97	.960	30	5.26	.741	12	4.24	1.08	.234

For interest, the 'Interaction' component of the *IWS Questionnaire* was divided and analyzed as two distinct subscales: 'Interaction Between Nurses,' and 'Interaction Between Nurses and Physicians.' The Combined Group acknowledged that

'Interaction Between Nurses' ($M = 5.08$, $SD = 1.24$), with a range of 2.40 to 7.00, was more satisfying than 'Interaction Between Nurses and Physicians' ($M = 4.86$, $SD = 1.07$), with a range of 1.40 to 6.40. As separate groups, nurses in Group 1 identified being more currently satisfied with 'Interaction Between Nurses' ($M = 5.37$, $SD = 1.13$), with a range of 3.20 to 7.00, than with 'Interaction Between Nurses and Physicians' ($M = 5.15$, $SD = .729$), with a range of 3.40 to 6.40. Similarly, nurses in Group 2 also reported being much more content with 'Interaction Between Nurses' ($M = 4.37$, $SD = 1.25$), with a range of 2.40 to 6.00, than with 'Interaction Between Nurses and Physicians' ($M = 4.12$, $SD = 1.43$), with a range of 1.40 to 6.00. In other words, although nurses in both groups reported more satisfaction with 'Interaction Between Nurses,' critical care nurses in Group 1 reported being more satisfied with both 'Interaction Between Nurses' and 'Interaction Between Nurses and Physicians' than those nurses in Group 2 (see Table 13).

Table 13

Index of Work Satisfaction (IWS): 'Interaction' Subscales

	Combined			Group 1			Group 2			
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*p*
Interaction (Nurse-Nurse)	42	5.08	1.24	30	5.37	1.13	12	4.37	1.25	.333
Interaction (Nurse-MD)	42	4.86	1.07	30	5.15	.729	12	4.12	1.43	.465

Further calculations with the *IWS Questionnaire* produced a Component Scale Score, a Component Mean Score, and a Component Adjusted (Weighted) Score. Briefly, the Component Scale Score is the *sum* of the average scores from the 44 'attitude' items in Part B. The Component Mean Score describes the *mean* score for each of the six components. The Component Adjusted (Weighted) Score identifies the level of importance placed on each component by the nurses. These scores assisted in the establishment of the 'Index' of work satisfaction, the numerical value that reflected the critical care nurses' overall level of job satisfaction. Although important in identification of the 'Index,' these scores (with the exception of the Component Mean Scores which had been used to validate SPSS calculations) were of little significance for this particular study (see Appendix E).

Finally, the *IWS Questionnaire* calculations ultimately produced a Total Scale Score, Mean Scale Score, and 'Index' of work satisfaction. The Total Scale Score, which represents an estimate of overall levels of Registered Nurse satisfaction, is the sum of the scores for all 44 'attitude' items on Part B of the scale. The possible range for the Total Scale Score was 44 to 308 points. For the Combined Group of nurses, the Total Scale Score was 199.19. Comparatively, the Total Scale Score of Group 1 was 203.7, and for Group 2, 188.1.

The Mean Scale Score represents the Total Scale Score divided by number of 'attitude' items. While a possible Mean Scale Score of one to seven exists on the *IWS Questionnaire,* the Combined Group Mean Scale Score was 4.5; for Group 1, the Mean Scale Score was 4.6, and for Group 2 was 4.3.

Lastly, the 'Index' of work satisfaction is the number generated by dividing the

Component Adjusted Score by the number of components of the scale. The 'Index' of work satisfaction is a composite value, reflective of both Part A (level of importance of each component), and Part B (current level of satisfaction for each of the components). Although most studies that have used the *IWS Questionnaire* have reported scores around 12.0, the range of the 'Index' is 0.9 to 37.1. In this study, the Combined Group 'Index' of work satisfaction was 14.0. As separate groups, Group 1 had an 'Index' of 14.0, while the 'Index' for Group 2 was 13.0. In other words, both groups of nurses as well as the Combined Group achieved an overall 'Index' of work satisfaction at or below the 50th percentile of the total possible score, representative of a low level of nursing satisfaction (see Table 14).

Table 14

Index of Work Satisfaction (IWS): Total Scale Score, Mean Scale Score, and 'Index' of Work Satisfaction

	Combined	Group 1	Group 2
Total Scale Score	199.19	203.72	188.07
Mean Scale Score	4.5	4.6	4.3
'Index' of Work Satisfaction	14.0	14.0	13.0

Factors Affecting Knowledge Acquisition and Knowledge Retention

To facilitate the possible identification of relationships between knowledge acquisition, knowledge retention, and demographic characteristics of the critical care nurses, a Chi-Square analysis was conducted. Of the most important demographic

characteristics examined, neither gender, highest level of Registered Nurse education, area of employment pre-critical care, current critical care unit, employment status, number of hours worked in one day, current critical care shift pattern, previous exposure to critical care, or previous critical care education course/program were related to *BKAT-6* examination scores at P1, P2, or P3.

To determine if significant relationships existed between the *BKAT-6* (P2) examination scores and CCNEP theory and clinical (practicum) grades, a bivariate correlation analysis was completed. A strongly positive statistically significant correlation existed between *BKAT-6* (P2) scores and CCNEP theory grades ($r = .666$, $p = .000$), whereas a lesser but still statistically significant positive correlation had occurred between *BKAT-6* (P2) scores and CCNEP clinical grades ($r = .319$, $p = .023$). Statistically significant relationships were also observed between the CCNEP theory and clinical practicum grades ($r = .406$, $p = .001$)(see Table 15).

Table 15

Bivariate Correlation: BKAT-6 (P2) Examination Scores and CCNEP Theory/Clinical Grades

	Correlations	CCNEP Theory Grade	CCNEP Clinical Grade
BKAT-6 (Phase 2)	Pearson's *r*	.666	.319
	p	**.000**	**.023**
CCNEP Theory Grade	Pearson's *r*		.406
	p		**.001**

To determine the effects of various situational factors of the critical care learning experience on the acquisition and retention of basic critical care nursing knowledge, a bivariate correlation was undertaken between the *BKAT-6* (P2) scores and each of the four situational factors. There were no statistically significant correlations between the *BKAT-6* (P2) scores or any of the situational factors. However, when all of the situational factors ('Preceptorship,' 'Opportunity for Practice,' 'Feedback,' and 'Overall Satisfaction') were compared, several statistically significant positive correlations were observed among the four factors: 'Preceptorship' and 'Opportunity for Practice' ($r = .664, p = .000$), 'Preceptorship' and 'Feedback' ($r = .484, p = .000$), 'Preceptorship' and 'Overall Satisfaction' ($r = .723, p = .000$), 'Opportunity for Practice' and 'Feedback' ($r = .495, p = .000$), 'Opportunity for Practice' and 'Overall Satisfaction' ($r = .657, p = .000$), and 'Feedback' and 'Overall Satisfaction' ($r = .413, p = .003$)(see Table 16).

Table 16

Bivariate Correlation: BKAT-6 (P2) Examination Scores and Situational Factors

	Correlations	PREC	PRAC	FEED	OVER
BKAT-6 (Phase 2)	Pearson's *r*	.904	.102	-.110	.185
	p	.510	.476	.442	.194
PREC	Pearson's *r*		.664	.484	.723
	p		**.000**	**.000**	**.000**
PRAC	Pearson's *r*			.495	.657
	p			**.000**	**.000**
FEED	Pearson's *r*				.413
	p				**.003**

PREC-Preceptorship; PRAC-Opportunity for Practice; FEED-Feedback (Verbal/Non-Verbal); OVER-Overall Satisfaction with Critical Care Education Program

Finally, relationships between *BKAT-6* (P3) scores and components of the *IWS Questionnaire* were explored. Equally important, to establish if a statistically significant relationship between knowledge retention and job satisfaction existed, all six components of the *IWS Questionnaire* ('Pay,' 'Autonomy,' 'Task Requirements,' 'Organizational Policies,' 'Professional Status,' and 'Interaction') were combined to produce one overall combined mean score of job satisfaction, which was then compared with *BKAT-6* (P3) scores.

There were no statistically significant correlations identified between the *BKAT-6* (P3) scores and 'Pay,' 'Autonomy,' 'Organizational Policies,' 'Professional Status,' 'Interaction,' or either subscale of the 'Interaction' component. There was, however, a significant correlation between *BKAT-6* (P3) scores and 'Task Requirements' ($r = .454, p = .003$). As well, several statistically significant positive correlations existed between separate components of the *IWS Questionnaire*: 'Autonomy' and 'Task Requirements' ($r = .537, p = .000$), 'Autonomy' and 'Organizational Policies' ($r = .522, p = .000$), 'Autonomy' and 'Professional Status' ($r = .312, p = .044$), 'Autonomy' and 'Interaction' ($r = .701, p = .000$), 'Autonomy' and 'Interaction (NN)' ($r = .652, p = .000$), 'Autonomy' and 'Interaction (NP)' ($r = .505, p = .001$), 'Task Requirements' and 'Organizational Policies' ($r = .317, p = .017$), 'Task Requirements' and 'Professional Status' ($r = .344, p = .027$), 'Task Requirements' and 'Interaction' ($r = .412, p = .007$), 'Task Requirements' and 'Interaction (NN)' ($r = .385, p = .013$), 'Organizational Policies' and 'Interaction' ($r = .420, p = .006$), 'Organizational Policies' and 'Interaction (NP)' ($r = .456, p = .002$), 'Professional Status' and 'Interaction (NN)' ($r = .308, p = .047$), 'Interaction' and 'Interaction

(NN)' (r = .857, p = .000), 'Interaction' and 'Interaction (NP)' (r = .804, p = .000), and 'Interaction (NN)' and 'Interaction (NP) (r = .382, p = .012) (see Table 17).

Table 17

Bivariate Correlation: Index of Work Satisfaction (IWS) Questionnaire Components

	CORR	AUTO	TASK	POLY	PROF	INT (C)	INT (NN)	INT (NP)
PAY	Pearson's *r*	.165	.309	-.204	.180	.003	.068	-.073
	p	.298	**.049**	.196	.254	.985	.669	.645
AUTO	Pearson's *r*		.537	.522	.312	.701	.652	.505
	p		**.000**	**.000**	**.044**	**.000**	**.000**	**.001**
TASK	Pearson's *r*			.371	.344	.412	.385	.292
	p			**.017**	**.027**	**.007**	**.013**	.064
POLY	Pearson's *r*				.206	.420	.257	.456
	p				.191	**.006**	.100	**.002**
PROF	Pearson's *r*					.265	.308	.119
	p					.090	**.047**	.454
INT (C)	Pearson's *r*						.857	.804
	p						**.000**	**.000**
INT (NN)	Pearson's *r*							.382
	p							**.012**

CORR-Correlation; PAY-Pay; AUTO-Autonomy; TASK-Task Requirements; POLY-Organizational Policies; PROF-Professional Status; INT(C)-Interaction (Nurse-Nurse and Nurse-Physician combined); INT(NN)-Interaction (Nurse-to-Nurse); INT(NP)-Interaction (Nurse-to-Physician)

Most importantly, when all components of the *IWS Questionnaire* were combined, a statistically significant correlation between *BKAT-6* (P3) test scores and overall job satisfaction of the critical care nurses existed (r = .392, p = .011).

CHAPTER FIVE

Discussion of Findings

The purpose of this study was to evaluate the acquisition and retention of basic critical nursing knowledge among a cohort of Registered Nurses who had enrolled in a 15-week adult critical care nursing education program (CCNEP). Nurses who participated in this study wrote the *BKAT-6*, a 100-item multiple-choice examination of basic critical care nursing knowledge, on three separate occasions. Phase 1 (P1) pre-program scores identified the baseline knowledge level of the nurses. Phase 2 (P2) post-CCNEP scores identified acquisition of knowledge of the nurses as a result of their participation in the nursing program. Six months after program completion, *BKAT-6* (Phase 3, P3) scores were utilized to identify the presence of a relationship between knowledge retention and job satisfaction. The Registered Nurses had all been hired into one of several critical care units in the region. Over a period of fifteen months, data were gathered from two consecutive groups of nurses, in September 2002 (Group 1) and February 2003 (Group 2). Both groups of nurses had participated in the same CCNEP, and none of the nurses had been informed they had written the same *BKAT-6* examination at each testing period.

Characteristics of the Critical Care Nurses

The Combined Group of nurses were very similar in many respects. The combined mean age of the Registered Nurses was 27.53 years, and most nurses (n = 42, 63.6%) graduated in the year this study began. Although the average length of employment pre-critical care was 29.74 months, most nurses (n = 42, 64.6%) had less than one year experience as a Registered Nurse. Most nurses had been hired into general

systems critical care units (n = 35, 57.4%), had been hired for full time positions (n = 59, 95.2%), and worked 12-hour (n = 61, 89.7%), and rotating (n = 61, 98.4%) shifts.

These findings were consistent with the literature that reports not only are younger nurses entering critical care nursing practice (Johangten, 2001), but health care employers are also more than willing, especially during periods of nursing shortages, to hire and train newly graduated Registered Nurses for critical care areas, regardless of previous experience as a Registered Nurse (Hartshorn, 1992; Oermann et al., 1992; Reising, 2002; Schempp & Rompre, 1986).

Acquisition and Retention of Basic Critical Care Nursing Knowledge

The Combined Group mean *BKAT-6* (P1) score was 61.81% (SD = 9.01) on the first day of the CCNEP. This was somewhat surprising, given that all nurses wrote the *BKAT-6* (P1) before the program instructors had delivered any content to the nurses. Although marks on the *BKAT-6* (P1) ranged between 41 to 79%, the nurses possessed enough knowledge to achieve a baseline of at least 60% before engaging in the critical care nursing experience. One reason why this may have occurred was that although the *BKAT-6* examination is a test of basic critical care nursing knowledge, questions representative of a more generalist nursing nature were also included as part of the examination. Students may also have possessed some unique knowledge from their undergraduate programs, perhaps as a result of research or a project, or had recalled situations from one's previous exposure to the critical care area, that might have assisted them with answering some of the questions.

At the conclusion of the CCNEP, the overall Combined Group *BKAT-6* (P2)

examination score increased to 76.10% (*SD* = 6.60). This increase in *BKAT-6* scores was consistent with what has been previously reported in the literature by Oermann et al. (1992), Price (1993), and Wynd and Gotschall (2000), who identified that critical care education programs can help facilitate the acquisition of basic critical care nursing knowledge. However, although *BKAT-6* scores increased from P1 to P2 for both groups of nurses, the mean increase was only 14.29%. This was somewhat less than what might have been anticipated following a CCNEP, and several reasons can be postulated as to why this may have occurred. Not all Registered Nurses participated in this study on a day off. Some nurses chose to combine their coffee and lunch breaks, and met with the researcher to complete their participation in the study while at work but away from the critical care unit. Similarly, some nurses had just completed night shift and had agreed to participate after only a few hours sleep. Not all the Registered Nurses in this study wrote their examinations in the same location during the second and final phases of this study, which may have also adversely affected test scores.

Moreover, overall *BKAT-6* (P3) scores remained similar to *BKAT-6* (P2) scores six months later, exhibiting a mean of 76.79% (*SD* = 6.62). The retention of basic critical care nursing knowledge six months post-CCNEP by this cohort of nurses was reflective of other findings by Ressler et al. (1991) and Wynn & Gotschall (2000).

The retention of basic critical care nursing knowledge in this Combined Group of nurses may have occurred because six months post-CCNEP may not have been a long enough time for a decline in critical care knowledge to have occurred. The nurses may also have been exposed to learning opportunities within the first six months of

employment, with several chances to formulate, apply, and integrate theory with skill while engaging in clinical practice. The Registered Nurses may have received support from critical care managers, critical care nurses, and other members of the health care team, including physicians, which reinforced and solidified basic critical care nursing knowledge. Likewise, given these nurses' recent entry into critical care nursing practice, they may have still been actively engaged in a "learning" mode. Although strongly encouraged not to study for the knowledge test, it would not have been unreasonable to expect that some nurses may have gone home after work and reviewed patient conditions they had observed in the clinical setting and/or read about various elements of critical care nursing practice.

BKAT-6 Scores and CCNEP Theory and Clinical Grades

An association was found between the *BKAT-6* (P2) scores and CCNEP theory grades of the Registered Nurses ($r = .666$, $p = .000$), while a weaker but still statistically significant correlation was found with the CCNEP clinical grades of the nurses ($r = .319$, $p = .023$). This was not entirely unexpected. It would be logical to have concluded that the content of any CCNEP would be reflective of both basic and perhaps more advanced concepts of critical care nursing practice. Likewise, it would not be unreasonable to expect that a test of basic critical care nursing knowledge, such as the *BKAT-6*, would reliably test for the acquisition and retention of concepts and information presented to nurses in a critical care educational opportunity.

Clinical practice of nurses, including critical care nurses, cannot exist without a theoretical foundation upon which to base and build future nursing practice (Creasia & Parker, 1991). While the *BKAT-6* examination appeared to ask nurses for very

specific information, the examination actually tested the ability of the nurses to apply basic concepts of critical care nursing practice. Both theory and clinical practicum components of the critical care nursing program had just concluded for the nurses when P2 study participation occurred. The connection between theoretical underpinnings of critical care nursing practice and its relationship to clinical practice of the critical care nurse may have been very immediate in nurses' minds. The *BKAT* examinations for critical care Registered Nurses have been consistently identified in the literature as an excellent measure of basic critical care nursing knowledge (Sakallaris, 1991; Santiano et al., 1994; Toth, 2003; Wynd and Gotschall, 2000).

BKAT-6 Scores and Situational Factors of the Critical Care Learning Experience

There were no relationships found between *BKAT-6* (P2) scores and any of the situational factors of the critical care learning experience, which included 'Preceptorship,' 'Opportunity for Practice,' 'Feedback,' and 'Overall Satisfaction.' The absence of a relationship between *BKAT-6* (P2) scores and situational elements of the learning experience might have been explained by the fact that nurses may have perceived the situational factors as having related more to the 'clinical' aspect of the experience than to the 'theoretical' aspect of the educational endeavor. Significant relationships were observed, however, between the four situational factors; perhaps one reason for this finding was that each of the factors of the learning experience are singularly important, yet highly interconnected pieces of the educational process, as has been identified by deYoung (1990), Huckabay (1980), and Quinn (1995).

It was interesting to observe that of the four situational factors,' Feedback' was the factor least believed to be of help to the nurses during the critical care learning

experience. Lauder et al. (1999) have described the milieu in which critical care nursing programs have been offered as one that could be both facilitative and detrimental to learning. Education programs and clinical placements can influence students positively or negatively, which can ultimately affect the acquisition and retention of critical care nursing knowledge. 'Feedback' from preceptors, critical care managers, peers, and other members of the health care team has always been an extremely vital component of the critical care nursing education experience (Lewis et al., 1992). One might speculate that nurses may not have received the feedback (either verbal, non-verbal, or in writing) that they wished they had received during the CCNEP. It might be suggested that the nurses may have been given feedback that was perceived as unhelpful or unwarranted. Registered Nurses may have perceived that feedback presented to them may not have helped facilitate, contribute to, or enhance overall learning during the CCNEP. Sources of feedback (or lack thereof) that nurses may have perceived as being least facilitative of learning were not assessed in this study.

BKAT-6 Scores and Job Satisfaction

To assess job satisfaction of the critical care Registered Nurses at six months (P3), each nurse completed the *IWS Questionnaire*, which not only assessed what the nurses perceived as important components of job satisfaction, but also assessed the current level of importance for each of the six components. Overall, the three most important components of job satisfaction for the Combined Group of nurses in this study were 'Autonomy,' 'Interaction,' and 'Professional Status.' Similarly, the components that the nurses perceived as having the greatest impact on their current

level of satisfaction as critical care nurses were 'Professional Status,' 'Interaction,' and 'Autonomy.' On the other hand, in terms of which components the critical care nurses' identified as both least important overall and least important in terms of current level of satisfaction, 'Task Requirements' and 'Organizational Policies,' were the least satisfying elements.

Examination of the six separate components of the *IWS Questionnaire* revealed several relationships among the components, which validated that job satisfaction among critical care nurses is a multi-dimensional entity (Dracup & Bryan-Brown, 1999; Stechmiller & Yarandi, 1992). Perhaps the most important finding of this study occurred when all six components of the *IWS Questionnaire* were combined to produce an overall mean score of job satisfaction for the Combined Group of nurses, which was then correlated with the *BKAT-6* (P3) scores. The presence of a significant relationship between knowledge retention and job satisfaction ($r = .392$, $p = .011$) in critical care Registered Nurses had not been previously identified.

Retention of basic critical care knowledge is important to fulfilling one's role as a responsible critical care nurse. 'Autonomy,' 'Interaction,' and 'Professional Status,' which are also important components of fulfilling one's role as a critical care nurse, appeared to be a significant source of satisfaction for the critical care nurses in this study, findings supported by other studies of job satisfaction in critical care nurses (Dear et al., 1982; Williams, 1990). The ability to become a critical care nurse may have created a renewed sense of professionalism for individuals. The capability of interacting with other members of the health care team, and one's ability to become gradually more autonomous in critical care decision making and assuming care for

patients with more complex problems is heavily dependant not only upon experience, but also the knowledge that each individual nurse has retained as a result of completion of the CCNEP and current critical care nursing experience. As a result, nurses may have derived satisfaction from believing that they had done their job as critical care nurses well with the knowledge that they possessed.

Limitations of the Study

This study occurred in only one particular health region. In addition, the small number of Registered Nurses who participated in all three phases of the study must also be seen as a limitation of this study. As a result, the small sample size limits the ability to generalize the findings of this study to other groups of Registered Nurses enrolled in adult critical care nursing education endeavors.

Not all nurses who participated in P1 of the study subsequently fulfilled their commitment and participated in P2 or P3. If a nurse refused to participate, they were no longer included in the study. If a nurse "failed-to-show" for an appointment with the researcher (despite e-mail reminders and a follow-up telephone call the night before the scheduled appointment), these nurses were also considered to have terminated their participation in the study and were not contacted for the remaining test periods.

Several factors may have influenced the Registered Nurse's decision not to participate in this study. All of the nurses had just completed an intensive CCNEP, and had written 18 examinations in nine weeks. The nurses may not have wanted to write any more examinations. Some nurses had already chosen to leave critical care areas before participation in the third and final phase of the study could be completed.

Nurses who had taken part in this study, as well as the primary investigator, all worked rotating shift work. Coordination of schedules, so as to inconvenience the nurses as little as possible and maintain their participation in the study, was extremely difficult. Registered Nurses who participated in the study may also have possessed characteristics that those who chose not to participate did not. Furthermore, there was no financial or any other type of incentive for the critical care nurses' to continue participating in the study.

Many of the Registered Nurses chose to write the second and third *BKAT-6* examinations in a variety of different locations, including public libraries and coffee shops. The extent to which extraneous factors within those environments may have affected knowledge scores of the nurses remains unknown.

Implications of Findings

Little is known about knowledge acquisition or knowledge retention in critical care nurses following critical care education programs. The literature review revealed researchers have occasionally focused on selected aspects of critical care nursing practice, such as critical care nurses knowledge about antibiotics (Munro & Grap, 2001), arterial catheters (McGhee & Woods, 2001), pulmonary artery catheters (Iberti et al., 1994) or cardiopulmonary resuscitation (Inwood, 1996; O'Steen et al., 1996). Few investigations have examined acquisition of basic critical care nursing knowledge among Registered Nurses as a result of completing a critical care nursing program, and even fewer studies have investigated the degree of knowledge retained six months after the conclusion of a critical care nursing education experience.

This study was the first to investigate acquisition and retention of basic critical

care nursing knowledge in Canadian critical care nurses. In addition, preceptorship, practice opportunities, and feedback have long been the mainstay components of any nursing educational experience. However, the degree of association between these factors, the overall satisfaction of learners with critical care nursing education experiences, and the identification of a relationship between these factors and the acquisition and retention of basic critical care nursing knowledge has not been previously studied. This study was unique; this study compared knowledge acquisition and knowledge retention to theory and clinical grades of students in an accredited critical care nursing education program, and evaluated various factors of the educational experience to acquisition and retention of critical care nursing knowledge. More importantly, this study investigated knowledge retention and job satisfaction among currently practicing Registered Nurses in critical care units.

From a theoretical perspective, this study has identified several important issues for critical care nursing education and critical care nursing practice. On one hand, critical care nursing education has primarily relied upon changes in technology and treatment of patients for guidance in curriculum development and training of nurses new to the critical care area. Over the past several years, an ever-increasing expanded body of knowledge has not only been the expectation but also a requirement of nurses who have entered critical care nursing practice. As a result, given both the depth and breadth of knowledge necessary for safe practice in modern day critical care units, it has been surprising how little research into knowledge acquisition, but more importantly, knowledge retention of critical care nurses, has actually occurred.

On the other hand, while it has almost universally been agreed upon that 100%

retention of content is unrealistic (Fiebert & Waggoner, 1996), the degree of knowledge retention required for safe critical care nursing practice has not been established. Although passing grades of 60, 70, or 80% were most often identified in the literature as a reflection of having possessed an adequate level of nursing knowledge post-critical care program, no study has yet established the degree of basic critical care nursing knowledge that must be retained to permit safe nursing practice. Similarly, research has not yet established baseline critical care nursing knowledge levels that would be reasonable to expect after one, three, or five years of critical care nursing practice. More importantly, the necessary degree of job satisfaction that must exist among critical care nurses to facilitate and enhance retention of basic critical care nursing knowledge has not yet been determined.

From a practical perspective, the complexities of patient care conditions, changing technology, and dissemination and internalization of information about the latest medical and nursing treatments are continual challenges for critical care nurse managers, critical care educators, and critical care nurses themselves. In-services and continuing education programs for personnel in critical care are of significant importance. The fact that the knowledge of the Registered Nurses involved in this study had not declined six months after the completion of a critical care nursing program should not imply that learning opportunities for critical care staff need not occur.

The importance of learning and education for critical care nurses cannot be underestimated, and the creation and development of such programs must be encouraged. Maintenance of knowledge, acquisition of newer knowledge, and

retention of basic knowledge is essential for the enhancement of critical care nursing education standards and refinement of critical care nursing practice. Given the anticipated shortage of critical care nurses that has been predicted over the next many years, and the number of new nursing graduates who wish to become part of the critical care team, there is a need for introducing critical care nursing education at the undergraduate level. As Hoffman (2001) and McGhee and Woods (2001) have suggested, groundwork could be laid in basic nursing education so that school of nursing programs, hospital training programs and preceptors can build upon common knowledge bases. At this time, no such programs exist within the Capital Health Region.

Further research into the acquisition, but more importantly, the retention of basic critical care nursing knowledge, and situational factors that can affect acquisition and retention of that knowledge, including job satisfaction, needs to occur over longer periods of time and with larger sample sizes. Information obtained from such investigations may help health care employers and others plan for future critical care nursing programs. The findings of such studies would be pertinent to employers who in recent years have hired newly graduated and inexperienced nurses for critical care units, and for schools of nursing to develop critical care education courses or programs for undergraduate students. The identification of existing knowledge bases of critical care nurses may lend support to critical care nurse managers and critical care educators in helping plan much more strategically for in-services and education programs that would be of benefit to critical care nurses. Such studies might also assist employers to identify changes that could be made within current critical care

units to enhance the job satisfaction of practicing critical care nurses.

Conclusion

Participation in an accredited critical care nursing education program had an impact on the knowledge scores of Registered Nurses who had chosen to become critical care nurses. Knowledge scores of the nurses in this study increased as a result of successful completion of a CCNEP. There was no decline in knowledge scores among the nurses six months after completing the CCNEP. Correlations were found between *BKAT-6* (P2) scores and CCNEP theory and clinical grades of the nurses, but no relationship was observed, however, between *BKAT-6* (P2) knowledge scores and situational factors of the education experience. A significant relationship between knowledge retention (as evidenced by *BKAT-6* (P3) scores) and job satisfaction of the critical care Registered Nurses six months post-critical care nursing program was observed.

The acquisition and retention of basic critical care nursing knowledge, an awareness of factors that can affect the acquisition and retention of that knowledge, including job satisfaction of critical care nurses, are of paramount importance. Evaluation of critical care nursing education, its effect on Registered Nurses, and the long-term outcomes of such programs only serve to improve and enhance the quality of care for critically ill and injured patients.

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Appendix A

"Knowledge Acquisition, Knowledge Retention and Job Satisfaction Among Registered Nurses Following a Critical Care Education Program"

NOTE: All of the following information will be held strictly confidential, and will be used solely for the purpose of compiling statistical information about characteristics of the Registered Nurses participating in this study.

DEMOGRAPHIC CHARACTERISTICS DATA SHEET

1. Age: _____

2. Gender: Male ❒ Female ❒

3. Highest level Registered Nurse education obtained:
   - R.N. ❒
   - B.Sc.N. ❒
   - Masters ❒
   - PhD ❒
   - Other ❒: _____

4. Year graduated from nursing school: _____

5. Length of time employed as a Registered Nurse:
   Years _____ or: Months _____ or: Days _____ or: Shifts _____

6. Was Critical Care your first area of employment as a Registered Nurse?
   Yes ❒ No ❒

7. If Critical Care was not your previous area of employment as a Registered Nurse, please indicate in which area you were employed **just before** Critical Care:

Community	❒	Health Oncology	❒
Emergency	❒	Operating Room	❒
Geriatrics	❒	Pediatrics	❒
Medicine	❒	Recovery Room	❒
Obstetrics	❒	Surgery	❒
Float	❒	Other: _____	

8. What was the length of employment in the area indicated in question 9?
   Years _____ or: Months _____ or: Days _____ or: Shifts _____

9. If you are currently employed as a Registered Nurse in Critical Care, the type of unit in which you are employed is:

Cardiac	❒	Surgery	❒
General Systems	❒	Thoracic/Vascular	❒
Medicine	❒	Other: _____	
Neurology	❒		

10. If you are currently employed in Critical Care, how long have you been working in Critical Care?
    Years _____ or: Months _____ or: Days _____ or: Shifts _____

11. The employment status which best describes your current Critical Care unit position is:
    Full Time ❒ Part-Time ❒ Casual ❒
    Other: _____

12. The number of hours you will normally work in one day in your current Critical Care unit position is:
    8 Hour Shifts ❒ 10 Hour Shifts ❒ 12 Hour Shifts ❒
    Other: _____

13. The shift pattern which best describes your current Critical Care unit position is:
    Days Only ❒ Evenings Only ❒ Nights Only ❒
    Rotating Days/Evenings/Nights ❒
    Other: _____

14. If you were not previously employed in Critical Care, have you had any previous exposure in this area?

Yes ❒ No ❒

15. If you were not previously employed in Critical Care but have had previous exposure in this area, what was that experience?

Student (i.e. Basic nursing program) ❒
Worked in Critical Care but not as a Registered Nurse ❒
Other: _____

16. If you were a Student Nurse in Critical Care, the type of unit in which you completed your Student experience was:

Cardiac ❒ Surgery ❒
General Systems ❒ Thoracic/Vascular ❒
Medicine ❒ Other: _____
Neurology ❒

17. If you were a Student Nurse in Critical Care, how long ago did that Student Nurse experience occur?

Years _____ or: Months _____ or: Days _____ or: Shifts _____

18. If you were a Student Nurse in Critical Care, the length of your Student experience was:

Years _____ or: Months _____ or: Days _____ or: Shifts _____

19. If you were Previously Employed in Critical Care but not as a Registered Nurse, the type of unit where you were previously employed was:

Cardiac ❒ Surgery ❒
General Systems ❒ Thoracic/Vascular ❒
Medicine ❒ Other: _____
Neurology ❒

20. If you were Previously Employed in Critical Care but not as a Registered Nurse, how long ago did that employment occur?

Years _____ or: Months _____ or: Days _____ or: Shifts _____

21. If you were Previously Employed in Critical Care but not as a Registered Nurse, the length of that employment was:

Years _____ or: Months _____ or: Days _____ or: Shifts _____

22. If you were Previously Employed in Critical Care but not as a Registered Nurse, the title of your job was:

Dietician	❒	Pharmacist	❒
Licensed Practical Nurse	❒	Physiotherapist	❒
Nursing Aide	❒	Service Aide	❒
Occupational Therapist	❒	X-Ray Technologist	❒
Respiratory Therapist	❒	Other: _____	

23. If you were previously employed in Critical Care and worked as a Registered Nurse, the type of unit where you previously worked was:

Cardiac	❒	Surgery	❒
General Systems	❒	Thoracic/Vascular	❒
Medicine	❒	Other: _____	
Neurology	❒		

24. If you were previously employed in Critical Care and worked as a Registered Nurse, how long ago did that employment occur?
    Years _____ or: Months _____ or: Days _____ or: Shifts _____

25. If you were previously employed in Critical Care and worked as a Registered Nurse, the length of that employment was:
    Years _____ or: Months _____ or: Days _____ or: Shifts _____

26. Have you previously taken a Critical Care Education Course or Program?
    Yes ❒ No ❒

27. If you have previously taken a Critical Care Education Course or Program, what type of Critical Care Educational Course or Program was it?

Community College	❒
Distance Education	❒
Hospital-Based	❒
Private Service Provider	❒
University-Based	❒

Other: _____

28. If you have previously taken a Critical Care Educational Course or Program, how long ago did the course or program occur?
    Years _____ or: Months _____ or: Days _____ or: Shifts _____

29. If you have previously taken a Critical Care Education Course or Program, the length of that course or program was:
    Years _____ or: Months _____ or: Days _____ or: Shifts _____

30. If you have previously taken a Critical Care Educational Course or Program, was that course or program taken:
    For Interest ☐
    For Educational Credit (eg. part of basic training) ☐
    For Employment Purposes ☐
    Other: _____

ADDITIONAL COMMENTS:
(please use the reverse side of this paper if necessary)

Thank you for taking the time to complete this survey.

Appendix B

"Knowledge Acquisition, Knowledge Retention and Job Satisfaction Among Registered Nurses Following a Critical Care Education Program"

NOTE: All of the following information will be held strictly confidential, and will be used solely for the purpose of compiling statistical information about characteristics of the Registered Nurses participating in this study.

SITUATIONAL FACTORS DATA SHEET

For each of the following questions, use the Lickert Scale to indicate the degree to which you agree or disagree with the following statements (please **circle** the number that reflects your response):

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	The Preceptorship Experience helped to facilitate my learning during the Critical Care Education Program.	1	2	3	4	5
2.	The Opportunity for Practice helped to facilitate my learning during the Critical Care Education Program.	1	2	3	4	5
3.	The Feedback (verbal, non-verbal, written) given to me helped my learning during the Critical Care Education Program.	1	2	3	4	5
4.	Overall, I was Satisfied with the Critical Care Education Program.	1	2	3	4	5

Additional Comments:
(please use the other side of this sheet if necessary)

Thank you for taking the time to complete this survey.

Appendix C

INFORMATION SHEET

"Knowledge Acquisition, Knowledge Retention and Job Satisfaction Among Registered Nurses Following a Critical Care Education Program"

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INTRODUCTION TO STUDY

I would like to invite you to participate in a study examining basic critical care nursing knowledge. Very little research has been conducted regarding knowledge retention in critical care nurses, and your participation will not only help achieve a greater understanding about how Registered Nurses acquire and retain information during and following critical care education programs, but also help other critical care educators plan, implement, and evaluate other critical care programs.

PURPOSE OF THE STUDY

The purpose of this study is to investigate the knowledge acquired and retained by Registered Nurses after completing an adult critical care education program. A secondary purpose of my study is to examine various demographic characteristics (age, gender, previous nursing experience, previous critical care experience) and situational factors (opportunity for clinical practice, feedback, preceptorship, and satisfaction with the education program) that might affect knowledge levels, and also to explore if there is any relationship between retention of critical care nursing knowledge and how satisfied you are in your job as a critical care nurse.

DATA COLLECTION PROCEDURE:

All Registered Nurses enrolled in the Edmonton on-site Level 1 Advanced Studies in Critical Care Nursing (ACCN) Program, offered by Mount Royal College, and co-sponsored by the Capital Health Region, are invited to participate.

DATA COLLECTION PROCEDURE (continued):

Data collection will occur in three separate stages:

STAGE 1: On the first day of the ACCN program, you will be asked to complete a Demographic Characteristics Data Sheet (identifying your age, gender, previous nursing experience and previous critical care experience) and a 100 item multiple-choice examination of basic critical care nursing knowledge.

STAGE 2: At the completion of the ACCN program, you will be asked to fill out a Situational Factors Data Sheet (indicating your satisfaction with clinical practice, feedback, preceptorship, and critical care education program) and a second 100 item multiple-choice examination testing basic critical care nursing knowledge. Permission has been obtained from Mount Royal College to release the ACCN theoretical course and clinical examination grades of participating students to the researcher for comparison with scores obtained on the basic critical care nursing knowledge examination.

STAGE 3: Six months after you have completed the ACCN program, you will be contacted by the researcher by telephone to choose from several different dates and times that will have been arranged to write a third 100 item multiple-choice test of basic critical care nursing knowledge, and, the Index of Work Satisfaction Questionnaire.

POTENTIAL BENEFITS:

An increased understanding about acquisition and retention of basic critical care nursing knowledge, factors that influence the acquisition and retention of knowledge, and discovery of a relationship between knowledge retention and job satisfaction may result from your participation in this study.

POTENTIAL RISKS:

There are no known risks to you as a result of participating in this study.

Upon completion of the study, at the participant's request, scores from the basic critical care nursing knowledge examination will be made available to you. The researcher will also make available the opportunity to review the examinations with each participant. Should a participant score poorly on one, two, or all three critical care nursing knowledge examinations, the researcher will facilitate (at the participant's request), identification of additional learning resources or sources of information.

TIME REQUIREMENTS:

For each of the three stages of this study, three 90-minute periods of time are required. Each examination of basic critical care nursing knowledge will take 45 minutes to 1 hour to complete. Thirty minutes has been allotted for filling out the Demographic Characteristics Data Sheet, Situational Factors Data Sheet, and Index of Work Satisfaction.

PARTICIPATION and CONFIDENTIALITY:

Your participation in this study is voluntary, and you may discontinue your participation at any time by contacting the researcher or by returning unanswered examinations, data sheets, or questionnaires, without repercussion or penalty. The researcher is the only person who will have access to your personal ACCN Program grades and study results. You will not be identified by name or any other distinguishing characteristics in the final report. The basic critical care nursing knowledge examination grades will not be provided to the Mount Royal College ACCN Program, or used for any type of clinical performance evaluation. All of the data concerning this study will be kept in a locked filing cabinet for a period of not less than five (5) years, and will not be made available to the Mount Royal critical care educators, Capital Health management, or to your peers for any kind of hiring, firing, or disciplinary measures.

CONTACT PERSON:

If you have any study-related questions or concerns about this study or your participation, you are free to page Eugene Mondor at (780) 419-9575.

You may also contact the Patient Relations Department of the Capital Health Authority at (780) 407-1040 with questions or concerns about any aspect of this study.

Participants Initials: _____ Researcher's Initials: _____

Appendix D

Part 1 (to be completed by the Principal Investigator):

Title of Project: Knowledge Acquisition, Knowledge Retention, and Job Satisfaction in Critical Care Registered Nurses Following a Critical Care Education Program

Principal Investigator:
Eugene E. Mondor, RN, BScN
Pager: (780) 419-9575

Thesis Supervisor:
Louise Jensen, RN, PhD
Phone: (780) 492-6795

Part 2 (to be completed by the research subject):

	Yes	No
Do you understand that you have been asked to be in a research study?	☐	☐
Have you read and received a copy of the attached Information Sheet?	☐	☐
Do you understand the benefits and risks involved in taking part in this research study?	☐	☐
Have you had an opportunity to ask questions and discuss this study?	☐	☐
Do you understand that you are free to withdraw from the study at any time, without having to give a reason and without affecting this education experience?	☐	☐
Has the issue of confidentiality been explained to you, and do you understand who will have access to your ACCN Program Grades and study results?	☐	☐

This study was explained to me by:

_____

I agree to take part in this study: YES ☐ NO ☐

Signature of Research Participant

_____

(Printed Name) _____

Date: _____

I believe that the person signing this form understands what is involved in this study and voluntarily agrees to participate.

Signature of Investigator _____ Date: _____

THE INFORMATION SHEET MUST BE ATTACHED TO THIS CONSENT FORM AND A COPY GIVEN TO THE RESEARCH SUBJECT

Appendix E

Index of Work Satisfaction (IWS) Questionnaire: Component Scale Scores, Component Mean Scores, Component (Weighted) Adjusted Scores

	Combined			Group 1			Group 2		
	CSS	CMS	CAS	CSS	CMS	CAS	CSS	CMS	CAS
Pay	27.19	4.53	13.68	26.43	4.40	13.29	29.08	4.85	14.55
Autonomy	37.85	4.73	18.07	38.97	4.87	18.41	35.08	4.38	17.61
Task Requirements	25.01	4.17	12.30	25.19	4.20	11.97	24.58	4.10	12.96
Organizational Policies	21.73	3.10	6.63	22.79	3.25	6.89	19.08	2.72	5.79
Professional Status	37.72	5.39	16.81	37.70	5.38	17.81	37.83	5.40	14.20
Interaction	49.69	4.97	17.59	52.64	5.26	18.46	42.42	4.24	15.86
Nurse-Nurse	25.41	5.08	-	26.87	5.37	-	21.84	4.37	-
Nurse-Physician	24.28	4.86	-	25.77	5.15	-	20.58	4.12	-

CSS: Component Scale Score; CMS: Component Mean Score;
CAS: Component Adjusted (Weighted) Score